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CBAM and its impact on India

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ABSTRACT

Carbon Border Adjustment Mechanism (CBAM), which is being implemented in a phase-wise manner in the European Union (EU), is becoming an object of trade disputes between the developing nations and the EU, as many emerging economies don't have their domestic carbon markets and their exporters will now face stiff tariff-like penalties for selling their products in the European market. This paper discusses the CBAM mechanism and its impact on India. The paper also talks about the political economy of the issue and the responses of the respective governments to protect their own economies. Lastly, the paper discusses the larger ramifications of the CBAM felt across the globe and the future directions. (keywords: CBAM, Carbon Price, EU tariff.

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1. BACKGROUND OF CLIMATE CHANGE AND GLOBAL CARBON PRICING

1.1 Climate Change Challenges in India

India is highly vulnerable to climate change due to its diverse geography, including the Himalayas and its long coastline. Over 80% of the population resides in areas prone to climate-induced disasters. These disasters include rising temperatures, erratic rainfall, declining groundwater, retreating glaciers, intense cyclones, and sea-level rise, leading to significant crises in livelihoods, food security, and the economy. Urban areas are also at increasing risk from extreme heat, floods, and disease, especially in areas with unplanned urbanization. Economic losses from extreme weather events have doubled in the last decade, threatening the country's overall development.

Climate change has begun to alter growing seasons in India. With approximately half of the Indian population working in agriculture, damage to productivity and health is significant. From 1901–2018, the average temperature in India rose by 0.7°C. During the summer monsoon season, India is experiencing more frequent dry spells and more intense wet spells. It is predicted that climate change will cause water shortages across Asia, including India, potentially affecting over a billion people by the 2050s. Additionally, heat waves in India are becoming more frequent and intense, with studies indicating they are 30 times more likely to occur due to climate change.

1.2 Carbon Pricing Mechanisms

To mitigate the impact of climate change and remain competitive in the global market, India needs to implement carbon pricing mechanisms and develop low-carbon technologies. Carbon pricing mechanisms like a carbon tax or an Emissions Trading System (ETS) can help Indian businesses comply with regulations and reduce the carbon intensity of their products.

Carbon Tax: A carbon tax could be implemented by changing the nomenclature of the coal component under the GST Compensation Cess to a 'carbon tax'. Other countries, such as Morocco, are considering carbon taxes considering the EU's CBAM.

Emissions Trading System (ETS): India is developing its compliance market, with initial steps taken in the form of a Carbon Credits Trading Scheme in 2023. The EU's Carbon Border Adjustment Mechanism (CBAM) has provided a renewed sense of urgency to the development of India's ETS. India is also taking a market- based approach to incentivize voluntary environmental actions by stakeholders, including the Green Credit Programme Implementation Rules, 2023, which aim to create a market-based mechanism providing tradable incentives for environment-positive actions

2. CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

The European Commission introduced the Carbon Border Adjustment Mechanism (CBAM) as part of the European Green Deal, which aims to achieve carbon neutrality in the EU by 2050. The CBAM is designed to ensure that imported products bear a carbon emission cost comparable to that imposed on goods

produced domestically within the EU, creating a level playing field. The impact of CBAM on India will depend on the carbon intensity of exported products and their substitutes in the EU market. Without an ETS, it could be difficult for Indian businesses to demonstrate that their products are produced using low- carbon technology, resulting in higher CBAM charges. CBAM may result in lower demand for Indian products, which would ultimately lead to trade diversion from India. A carbon price paid in India can lead to a corresponding deduction in CBAM's obligation.

2.1 CBAM Definition, Objective & Key Features

Definition of CBAM

The EU's Carbon Border Adjustment Mechanism (CBAM) is a carbon tariff on carbon-intensive products imported into the European Union, such as steel, cement, aluminum, fertilizers, hydrogen and electricity. It is designed to put a fair price on the carbon emitted during the production of these goods. The CBAM aims to ensure that the carbon price of imports is equivalent to the carbon price of domestic production, so the EU's climate objectives are not undermined.

Objectives of CBAM

The key objectives of the CBAM are to:

- Reduce carbon emissions by ensuring that imported goods are subject to the same carbon costs as products produced within the EU.
- Prevent carbon leakage, which occurs when companies move carbon-intensive production abroad to countries with less stringent climate policies, or when EU products are replaced by more carbon- intensive imports.
- Encourage cleaner industrial production in non-EU countries.
- Equalize the price of carbon between domestic products and imports in selected sectors.
- Create a level playing field for EU producers by imposing a carbon price on imports.

Key Features of CBAM

- **Scope:** Initially, CBAM applies to imports of certain goods with a high risk of carbon leakage, including cement, iron and steel, aluminum, fertilizers, hydrogen and electricity. The EU plans to assess and potentially expand the coverage of CBAM by 2030, aiming to include over half of the emissions in the EU Emissions Trading System (ETS) sectors by the full phase-in of CBAM in 2034.
- **Implementation:** CBAM is being implemented in phases.
- **Transitional Phase (October 1, 2023, to December 31, 2025):** Importers of goods in the specified carbon-intensive sectors must report the quantity of goods imported and their embedded greenhouse gas (GHG) emissions every quarter, without any financial payments or adjustments. This phase serves as a pilot and learning period for importers, producers, and authorities.
- **Definitive Regime (Beginning in 2026):** Importers will have to declare the quantity of goods imported into the EU and their embedded GHG emissions annually. To offset these emissions, importers will need to surrender a corresponding number of CBAM certificates, the price of which

will be based on the weekly average auction price of EU Emission Trading System (ETS) allowances

in €/tonne of CO2 emitted.

- **CBAM certificates:** Importers will need to purchase CBAM certificates to account for the carbon emissions embedded in their imported goods. The price of CBAM certificates is linked to the price of EU allowances under the European Union Emissions Trading System.
- **Compatibility with WTO rules:** The CBAM is designed to be compatible with WTO rules.

2.2 Historical Context: Evolution from EU ETS to CBAM

The CBAM complements the existing EU Emissions Trading System (ETS). The EU ETS is a "cap and trade" system that incentivizes carbon emitters to reduce their emissions by creating a carbon market. There is a limit on the total amount of greenhouse gases that companies can emit each year. This system is monitored through a fixed number of allowances distributed to companies, which they must use to cover their emissions. The CBAM is designed to prevent carbon leakage, which could undermine the EU's climate goals as the EU raises its own climate ambition. The CBAM will also permit the EU to stop giving free allowances to some carbon-intensive sectors within its borders.

3. EU'S CLIMATE GOALS AND CBAM'S ROLE

3.1 EU's Climate Ambitions

Targets: The European Union (EU) has set ambitious climate targets, including reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels and achieving carbon neutrality by 2050. The EU is required to establish a binding climate target for 2040 as an intermediate goal between the 2030 target and the goal of net-zero emissions by 2050. The European Commission has recommended a 90% emissions reduction by 2040 compared to 1990 levels.

Challenges: Despite these targets, the EU faces challenges such as carbon leakage and embedded emissions in imports. Carbon leakage occurs when companies move carbon-intensive production to countries with less stringent climate policies, or when EU products are replaced by more carbon-intensive imports. Current projections suggest that, even if all planned climate policies are implemented, the bloc's emissions are set to fall 48% by 2030, rather than 55%.

3.2 How CBAM Works

Mechanism Design: The Carbon Border Adjustment Mechanism (CBAM) is designed to address these challenges by putting a fair price on the carbon emitted during the production of certain goods imported into the EU. CBAM is being implemented in phases.

- **Transitional Phase (October 1, 2023 to December 31, 2025):** Importers of goods in the specified carbon-intensive sectors must report the quantity of goods imported and their embedded greenhouse gas (GHG) emissions on a quarterly basis, without any financial payments or adjustments.
- **Definitive Regime (Beginning in 2026):** Importers will have to declare the quantity of goods imported into the EU and their embedded GHG emissions annually. To offset these emissions, importers will need to surrender a corresponding number of CBAM certificates, the price of which

will be based on the weekly average auction price of EU Emission Trading System (ETS) allowances

in €/tonne of CO2 emitted.

Covered Sectors: CBAM initially applies to imports of certain goods with a high risk of carbon leakage, including cement, iron and steel, aluminum, fertilizers, hydrogen and electricity. The EU plans to assess and potentially expand the coverage of CBAM by 2030, aiming to include over half of the emissions in the EU Emissions Trading System (ETS) sectors by the full phase-in of CBAM in 2034.

Alignment with International Climate Agreements

CBAM is part of the Green Pact for Europe and is designed to be compatible with WTO rules. The 2040 target is aligned with the recommendations of the European Scientific Advisory Board on Climate Change, which analysed the scientific evidence against criteria including global fairness, technological feasibility and social acceptability, and determined an appropriate range for the 2040 emissions reduction target of between 90-95 per cent.

4. STRATEGIES FOR INDIAN EXPORTERS TO TACKLE CBAM

4.1 Improving Carbon Footprint

4.2 Reducing Scope 1, 2, and 3 Emissions by investing in cleaner technologies

A large portion of manufacturer carbon footprints tends to originate in scopes 1 and 2 - emissions occurring on-premises or from the purchase of energy. In general, manufacturers use high quantities of carbon- intensive fossil fuels like natural gas and diesel. Therefore, manufacturers can achieve significant decarbonization by reducing their usage of these fuels. In scope 1, manufacturers can drive reductions by replacing on-premises fossil fuel sources with low/no carbon energy sources like biomass, recovered heating, heat pumps, and electric heating. In scope 2, switching to renewable energy sources can also make impactful reductions to carbon emissions. To validate an energy source's renewability, manufacturers should look for those backed with Guarantees of Origin (GOs) or Renewable Energy Certificates (RECs). In addition, once manufacturers are operating on renewable energy, they can earn yet more reductions by electrifying their vehicle fleets. While scope 1 and 2 emissions may form a large share of manufacturer carbon footprints, there are still sizable reductions to be found in scope

3. Scope 3 reduction initiatives will vary widely by type of manufacturer, but many of these reductions are found in procurement – for instance, by switching to materials with a higher percentage of recycled content. (Source)

4.3 Optimizing Production Processes

Optimizing production processes through methodologies like Lean and Six Sigma can significantly reduce a company's carbon footprint by minimizing waste, improving efficiency, and streamlining resource use. Lean manufacturing focuses on eliminating non-value-added activities, or "waste," which often include excess energy consumption, overproduction, and unnecessary material usage. By identifying and removing these inefficiencies, companies can reduce their energy demands and material inputs, directly lowering greenhouse gas emissions. For instance, Toyota, a pioneer of Lean principles, has consistently reduced its environmental impact by cutting waste in its production systems (Liker, 2004). Similarly, Six Sigma emphasizes data-driven decision-making to reduce variability and defects in processes. This approach can lead to more precise control over energy use and raw material consumption, further decreasing emissions. A study by Sunder (2013) highlighted how Six Sigma projects in manufacturing sectors have resulted in reduced energy consumption and waste generation, contributing to lower carbon footprints. Additionally,

integrating Lean and Six Sigma with sustainability goals—often referred to as "Green Lean" or "Lean and Green"—can amplify these benefits. For example, reducing machine idle times or optimizing production schedules can lead to fewer energy-intensive operations, as noted by Dües et al. (2013). By systematically addressing inefficiencies, companies not only improve operational performance but also align with environmental sustainability objectives, demonstrating that process optimization and carbon reduction are mutually achievable goals.

As per a survey conducted by BCG, the renewable energy value chain is the most attractive opportunity to reduce manufacturing sector GHG emissions with 64% of respondents expressing interest. Around 45% of organizations surveyed expressed their intent to invest in the e-mobility value chain. On the other hand, an increase in domestic gasoline costs, along with relatively low ethanol purchasing prices, are boosting ethanol use and it is reflected in the survey as well with more than 40% of the respondents showing interest in investing in biofuels. Above-average sugarcane harvests have played no small part to boost output as well. During 2016–21, the annual ethanol consumption of India grew by 12%, on average, over the five years, and similarly, nearly 42% of the industries were practicing biofuel generation and consumption. Most investments in biofuels were concentrated in the automotive, technology, consumer goods, and cement industries.

As illustrated in the image below, the report by Boston Consulting Group highlights the most effective green practices across various industries.. (Source)

Exhibit 10: Most Attractive Green Ventures/Practices

Higher than overall % of selection
Lower than overall % of selection

Green Ventures/ Practices	Overall	Automotive	Cement	Consumer Goods	Financial Services	Manufacturing	Oil & Gas	Power & Utilities	Professional Services	Technology	Metals
Renewable energy value chain	64%	86%	53%	61%	69%	43%	67%	83%	82%	58%	50%
E-mobility value chain	44%	86%	47%	26%	56%	57%	0%	42%	36%	58%	33%
Biofuels	42%	57%	47%	48%	38%	38%	42%	33%	27%	58%	17%
Nature-based solutions	38%	36%	60%	48%	31%	38%	8%	42%	36%	25%	33%
Carbon capture and storage	37%	50%	53%	35%	25%	14%	50%	25%	27%	42%	42%
Green hydrogen	36%	43%	47%	26%	31%	29%	58%	50%	45%	25%	33%
Forestation	28%	29%	33%	35%	19%	29%	33%	17%	18%	17%	33%
Conserving existing carbon sinks	27%	36%	53%	30%	0%	19%	25%	8%	9%	25%	25%
Others	6%	7%	7%	0%	13%	5%	17%	8%	9%	0%	8%

Note: The respondents were asked to select all possible relevant answers on behalf of their organization.
*Technology has been created as a subset from Professional Services.

4.4 Market Diversification

Market diversification can be a powerful strategy for Indian exporters to mitigate the impact of the Carbon Border Adjustment Mechanism (CBAM) regulations. By expanding their export destinations beyond the European Union (EU), Indian exporters can reduce their dependency on EU markets, which are subject to CBAM1. This approach helps in minimizing the financial burden imposed by CBAM on carbon-intensive products. For instance, Indian steel exporters have been exploring new markets in Africa, Latin America, and the Middle East. Countries like Benin, Congo, Egypt, Mexico, Qatar, Somalia, Turkey, and the United Arab Emirates have been identified as potential markets. By tapping into these markets, Indian exporters can maintain revenue streams and reduce the distortionary effects of CBAM. Additionally, diversifying markets allows Indian exporters to leverage competitive advantages in regions with less stringent environmental regulations. This can help in maintaining profitability while gradually adapting to global sustainability standards. (Source1, Source2)

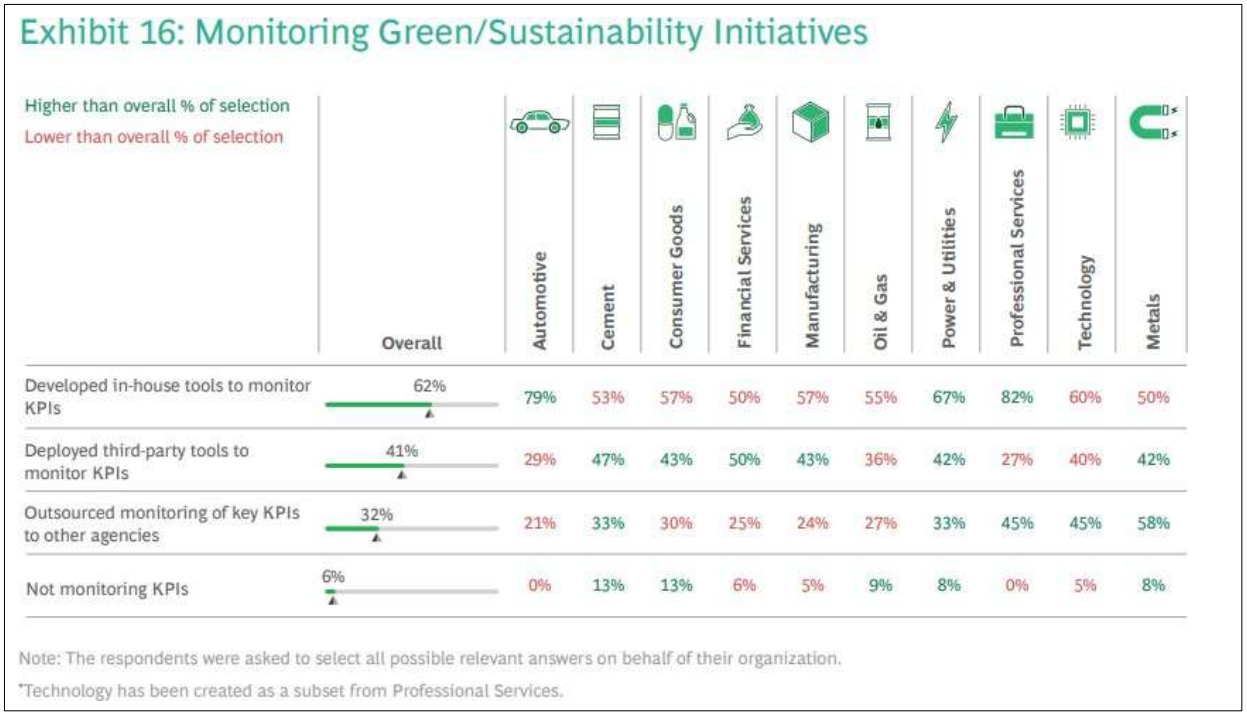
4.5 Robust Systems for Carbon Accounting and Reporting

The implementation of the CBAM presents significant administrative and technical challenges for Indian manufacturers. The reporting obligation mandates the disclosure of the quantity of imported goods, their embedded carbon emissions, and any applicable carbon costs incurred in the exporting country. This requirement poses significant challenge for Indian exporters, who in the absence of proper technological means must adhere to the EU standards by monitoring, calculating, reporting, and verifying emissions. Small Indian industries may face disadvantages similar to those experienced during the implementation of EU's Registration, Evaluation, Authorization and Restriction of Chemicals ("REACH") Regulation in 2006. The CBAM framework has also established a mechanism for determining the carbon footprint of imported goods in instances where precise embedded emissions data is unavailable. In such scenarios, default values will be utilized. These default values are derived from the best available secondary data on the carbon footprint of CBAM-covered goods. However, if reliable data remains inaccessible, the default values will be based on the average emissions intensity of the worst-performing installations within the relevant EU Emissions Trading Scheme ("EU ETS") sector. Furthermore, total declared

emissions must undergo verification by accredited verifiers. India's inadequate data infrastructure for emissions collection may necessitate default emission data usage, potentially resulting in increased costs due to mark-ups imposed by the European Council. This may necessitate technological upgrades and robust data management systems. (Source)

The centrality of sustainability and green transition is actively associated with effective monitoring and evaluation. India is working diligently to shape its SDGs and has prioritized implementation as a necessity to achieve the goals by 2030. Therefore, the adoption of effective monitoring systems and keeping track of related technological advances will play an important role in assessing and fixing the implementation gap.

Therefore, the impact assessment of ESG practices at an industry level (at regular intervals) and the localization of sustainability goals are critically important for setting and achieving industry-level targets. As per BCG (Report), queries about an organization's assessment of sustainability KPIs revealed that the method to monitor and evaluate sustainable initiatives via digital tools and technology upgrades is effective in practice among a large share of survey respondents across industries.



5. GOVERNMENT AND POLICY RESPONSES

India has been actively responding to the European Union's Carbon Border Adjustment Mechanism (CBAM) through a combination of domestic initiatives, diplomatic efforts, and policy recommendations. Below is a detailed breakdown of India's responses, along with references where applicable.

5.1 India's Domestic Initiatives

1. Carbon Credit Trading Scheme (CCTS)

India has introduced the Carbon Credit Trading Scheme (CCTS) under the Energy Conservation (Amendment) Act, 2022. This scheme aims to establish a domestic carbon market to incentivize industries to reduce greenhouse gas (GHG) emissions. By creating a framework for trading carbon credits, India seeks to align its industries with global climate goals and mitigate the impact of CBAM on its exports. (Source)

2. Green Hydrogen Mission

India has launched the National Green Hydrogen Mission to promote the production and use of green hydrogen, a clean energy source. The mission aims to make India a global hub for green hydrogen production, reducing the carbon intensity of its industries and enhancing their competitiveness in international markets.

(Source)

3. SEBI's ESG Guidelines and Business Responsibility Reports

The Securities and Exchange Board of India (SEBI) has mandated Environmental, Social, and Governance (ESG) disclosures for listed companies. These guidelines require companies to submit Business

Responsibility and Sustainability Reports (BRSR), which include details on their carbon emissions and sustainability practices. This move aims to improve transparency and encourage Indian businesses to adopt greener practices. (Source)

5.2 Diplomatic Efforts

1. WTO/G20 Complaints Against CBAM

India has raised concerns at the World Trade Organization (WTO) regarding CBAM, arguing that it acts as a trade barrier and discriminates against developing countries. India contends that CBAM could disproportionately affect its export-oriented industries, such as steel, aluminium, and cement, by imposing additional costs. (Source)

2. India-EU FTA Negotiations

India is engaging in Free Trade Agreement (FTA) negotiations with the European Union, advocating for exemptions or transition periods for its industries under CBAM. India is pushing for a phased implementation of CBAM to allow its industries time to adapt to the new regulations. (Source)

5.3 Policy Recommendations

1. Standardizing GHG Measurement Frameworks

India is working towards standardizing GHG measurement frameworks to ensure accurate and consistent reporting of emissions. This will help Indian industries align with international standards and reduce the risk of penalties under CBAM. (Source)

2. Incentivizing R&D in Clean Technologies

The Indian government is offering incentives for Research and Development (R&D) in clean technologies, such as carbon capture and storage, renewable energy, and energy efficiency. These initiatives aim to reduce the carbon footprint of Indian industries and enhance their global competitiveness. (Source)

6. IMPACT ANALYSIS ON INDIA

6.1 Economic Implications

Trade volume with the EU: Key export sectors

The European Union (EU) is India's second-largest trading partner, accounting for 11.1% of India's total trade in goods in 2022. India's exports to the EU stood at $74.8 billion, with key sectors including steel, aluminum, cement, and fertilizers, all of which are subject to the Carbon Border Adjustment Mechanism (CBAM).

Key Export Sectors Affected by CBAM:

1. Steel & Iron: Exports to the EU reached $5.5 billion in 2022, making up 27% of India's total steel

exports. The CBAM's high carbon pricing could significantly impact India's steel industry.

2. Aluminum: India exported $2.2 billion worth of aluminum products to the EU, mainly in semi- fabricated and raw aluminum forms. EU tariffs under CBAM could erode cost competitiveness.
3. Cement & Fertilizers: Though exports are relatively low, rising input costs due to compliance requirements could disrupt these industries.

With the EU implementing €90 per ton of CO_2 emissions pricing, Indian exporters may face higher compliance costs, reducing trade competitiveness. Industry experts suggest that bilateral agreements or carbon credit adjustments are necessary to mitigate trade disruptions.

Projected GDP loss (0.05%) and sectoral profit declines

The European Union's (EU) implementation of the Carbon Border Adjustment Mechanism (CBAM) is poised to have significant economic repercussions for India, particularly affecting its Gross Domestic Product (GDP) and the profitability of key industrial sectors.

A comprehensive analysis by the Centre for Science and Environment (CSE) indicates that the CBAM could impose an additional 25% tax on carbon-intensive goods exported from India to the EU. This tax burden is projected to equate to approximately 0.05% of India's GDP, based on export data from the fiscal year 2022- 2023. The primary sectors impacted

include steel, iron, aluminum, cement, and fertilizers, which collectively constitute about 9.91% of India's total exports to the EU.

The steel industry stands out as particularly vulnerable to the financial strains introduced by the CBAM. Indian steel producers, characterized by higher carbon emission intensities, are expected to face substantial profit reductions. Estimates suggest a decline ranging from $65 to $160 per metric ton of steel exported to the EU between 2026 and 2036. This anticipated downturn is attributed to the increased costs associated with compliance and the carbon taxes levied under the CBAM framework.Moreover, the broader profitability of Indian steel companies exporting to the EU is projected to diminish by 25–30% post-CBAM implementation. This significant impact underscores the pressing need for Indian manufacturers to adopt greener production methodologies to remain competitive in the international arena.

Increased compliance costs and carbon pricing disparities

The European Union's Carbon Border Adjustment Mechanism (CBAM) introduces significant compliance costs for Indian exporters, particularly in carbon-intensive sectors such as steel, aluminum, cement, and fertilizers. To align with CBAM requirements, these exporters must invest in advanced emissions monitoring and reporting systems that meet EU standards, necessitating substantial financial outlays. Additionally, the disparity in carbon pricing between the EU and India exacerbates the financial strain. While the EU's Emissions Trading System (ETS) has seen carbon prices reaching approximately €63 per tonne of CO_2 as of September 2021, India's carbon tax is markedly lower, at around USD $1.6 per tonne of CO_2. This discrepancy means that Indian exporters face higher costs when accessing the EU market, as they must purchase CBAM certificates to cover the difference in carbon pricing. Consequently, the combined burden of compliance investments and carbon price differentials poses a significant challenge to the competitiveness of Indian goods in the European market.

6.2 Sectoral Deep Dive

India's steel industry is characterized by a notably high carbon intensity, emitting approximately 2.6 tons of CO_2 per ton of finished steel. This figure significantly surpasses the global average emission intensity of 1.85 tons of CO_2 per ton of crude steel and is markedly higher than the European Union's (EU) average of 1.9 tons of CO_2 per ton of steel.

The elevated emissions in India's steel production are primarily attributed to the prevalent use of coal- based Direct Reduced Iron (DRI) processes. This method emits between 3.0 to 3.1 tons of CO_2 per ton of steel, significantly higher than the emissions from Electric Arc Furnaces (EAFs), which are approximately 0.7 tons of CO_2 per ton of steel. The limited availability of scrap metal and natural gas in India further reinforces reliance on coal-based methods.

In contrast, the EU's steel industry predominantly utilizes the Blast Furnace-Basic Oxygen Furnace (BF-BOF) route, which, while still carbon-intensive, benefits from more efficient technologies and stricter environmental regulations, resulting in lower emissions. The EU is also actively exploring and implementing innovative methods, such as hydrogen-based steel production, to further reduce carbon footprints.

Addressing the disparity in carbon intensity is crucial for India's steel sector, especially in light of global moves towards carbon border adjustment mechanisms like the EU's CBAM. Transitioning to less carbon- intensive technologies, enhancing energy efficiency, and increasing the use of renewable energy sources are imperative steps for India to align its steel industry with international environmental standards and maintain competitiveness in the global market.

Sector Vulnerability analysis

Cement

India's cement industry, a notable exporter to the EU, is characterized by energy-intensive production methods, primarily reliant on coal. The CBAM will impose carbon tariffs on imports based on their embedded emissions, potentially reducing the competitiveness of Indian cement in the European market. Estimates suggest that profit margins for Indian cement producers could decline by $65 to $160 per metric ton between 2026 and 2036 due to CBAM-related costs.

Aluminum Sector Vulnerability

The aluminum industry in India, with approximately 27% of its exports directed to the EU, faces significant challenges under CBAM. Production is heavily dependent on coal-based power, resulting in higher carbon emissions compared to European counterparts. This disparity could lead to additional costs of $1,500 to

$1,600 per ton of aluminum exported to the EU, eroding the price competitiveness of Indian aluminum in the European market.

Fertilizer Sector Vulnerability

India's fertilizer industry, particularly in the production of nitrogen-based fertilizers, is energy-intensive and relies on fossil fuels, leading to substantial greenhouse gas emissions. With the EU being a significant market, the CBAM's carbon tariffs

could increase the cost of Indian fertilizers, making them less competitive. This scenario may compel Indian producers to invest in cleaner technologies and alternative energy sources to reduce emissions and maintain market share.

Tata Steel case study

Tata Steel, a prominent player in the global steel industry, is proactively addressing the challenges posed by the European Union's **Carbon Border Adjustment Mechanism (CBAM)**. The CBAM, effective from 2026, imposes carbon tariffs on imports based on their embedded emissions, significantly impacting carbon- intensive industries like steel.

Strategic Initiatives for Decarbonization

Recognizing the imperative to reduce carbon emissions, Tata Steel has embarked on several strategic initiatives:

1. **Transition to Electric Arc Furnaces (EAFs):** In a landmark move, Tata Steel has committed to replacing traditional blast furnaces at its Port Talbot facility in Wales with EAFs. This transition, supported by a £500 million investment from the UK government and an additional £750 million from Tata Steel, aims to reduce the site's carbon emissions by 90%, equating to an annual reduction of approximately 5 million tonnes of CO_2. The project is slated for completion by 2027.
2. **Adoption of HIsarna Technology:** Tata Steel is advancing the HIsarna ironmaking process, which allows for the direct processing of iron ore into liquid iron without the need for agglomeration or coke production. This method has demonstrated the potential to reduce CO_2 emissions by over 50% compared to traditional processes.
3. **Renewable Energy Integration:** The company has entered into an agreement with Tata Power to source 379 MW of captive renewable power. This initiative is projected to reduce carbon emissions by 50 million tonnes over a 25-year period, supplying green energy to facilities in Jamshedpur, Kalinganagar, and the upcoming EAF project in Ludhiana, Punjab.

6.3 Compliance Challenges

India faces significant compliance challenges in aligning with global carbon reduction initiatives, particularly due to data gaps in standardized greenhouse gas (GHG) measurement and technological barriers in adopting low-carbon technologies.

Data Gaps: Lack of Standardized GHG Measurement

Accurate GHG measurement is foundational for effective emissions management and compliance with international standards. In India, the absence of a mandatory, standardized framework for GHG accounting has led to inconsistent reporting practices across industries. This inconsistency hampers the country's ability to accurately assess its carbon footprint and implement targeted mitigation strategies.

To address this, the **India Greenhouse Gas Program (India GHG Program)** was launched as a voluntary initiative aimed at standardizing GHG measurement and management. Established in 2012 by the World Resources Institute (WRI) India, the Confederation of Indian Industry (CII), and The Energy and Resources Institute (TERI), the program provides tools and technical assistance to companies for measuring emissions, identifying reduction opportunities, and tracking progress. Despite its contributions, the program's voluntary nature limits its reach, and a significant number of enterprises, especially small and medium- sized ones, remain outside its purview. This gap underscores the need for a comprehensive, mandatory GHG reporting framework to ensure uniformity and inclusivity in emissions data collection.

Technological Barriers: Adoption of Low-Carbon Technologies

Transitioning to low-carbon technologies is imperative for India to meet its climate goals. However, several barriers impede this shift:

4. **High Capital Expenditure**: The initial investment required for low-carbon technologies, such as carbon capture, utilization, and storage (CCUS) or green hydrogen production, is substantial. For instance, decarbonizing India's steel and cement sectors would necessitate significant financial resources, with costs varying based on the specific technology and scale of implementation.

5. **Technological Maturity**: Many low-carbon solutions are still in developmental stages or lack large- scale deployment experience in the Indian context. This uncertainty makes industries hesitant to adopt new technologies without proven efficacy and reliability.
6. **Infrastructure Deficits**: The successful implementation of low-carbon technologies often requires supporting infrastructure, which is currently inadequate. For example, the integration of renewable energy into the grid demands advanced storage solutions and grid management systems, areas where India is still developing capacity.

7. **Skill Shortages**: The renewable energy sector in India faces a significant skills gap, with an estimated shortage of around 1.2 million skilled workers. This deficit hampers the operation and maintenance of new technologies, affecting their performance and adoption rates.

7. COMPARATIVE ANALYSIS

The European Union (EU) and the United Kingdom (UK) have established Emissions Trading Systems (ETS) as market-based approaches to reduce greenhouse gas emissions. India is in the process of developing its own carbon pricing mechanism through the draft Green Credit Programme. Below is a comparative analysis of these systems, focusing on their key features, price trends, and market impacts.

7.1 CBAM vs. Other Carbon Pricing Mechanisms

EU ETS vs. UK ETS vs. India's Draft Green Credit Programme

Feature	**EU Emissions Trading System (EU ETS)**	**UK Emissions Trading System (UK ETS)**	**India's Draft Green Credit Programme**
Scope	Covers power generation, energy- intensive industries, and aviation within EU member states.	Applies to power generation, energy- intensive industries, and domestic aviation in the UK.	Proposed to incentivize environmentally sustainable actions across various sectors, details under development.
Cap and Allocation	Implements a cap that reduces annually; allowances are auctioned or allocated for free based on benchmarks.	Initially set at 5% below the UK's notional share of the EU ETS cap; allowances are auctioned with some free allocation.	Details on cap and allocation mechanisms are yet to be finalized.
Carbon Pricing	As of October 2024, prices are approximately €62.50 per metric ton, with projections reaching €111.14 by 2027.	Prices have experienced volatility, with £64.90 per metric ton in January 2024.	Pricing mechanisms are under consideration, aiming to establish a market-driven approach.
Market Stability Measures	Utilizes a Market Stability Reserve to address surplus allowances and price volatility.	Prices have experienced volatility, with £64.90 per metric ton in January 2024.	Pricing mechanisms are under consideration, aiming to establish a market-driven approach.
Linkage	Operates independently but discussions on linking with other systems are ongoing.	Currently independent, with considerations for potential linkage with the EU ETS.	Designed as a domestic initiative, with future linkage possibilities to be explored.

Price Trends and Market Impacts

- **EU ETS**: Carbon permit prices have shown an upward trajectory, influenced by policy measures aimed at reducing emissions. Analysts project that prices could rise to €111.14 per metric ton by 2027, driven by initiatives like the "Fit for 55" package, which seeks a 55% reduction in greenhouse gas emissions by 2030 compared to 1990 levels.
- **UK ETS**: The UK carbon market has experienced price volatility since its inception in 2021. Prices reached £64.90 per metric ton in January 2024. Factors contributing to this volatility include economic conditions and energy demand fluctuations.
- **India's Draft Green Credit Programme**: As the program is still under development, specific price trends are not yet available. The initiative aims to create a market for green credits, encouraging sustainable practices across various sectors.

7.2 Global Responses to CBAM

Reactions from the United States

In the United States, discussions around carbon border adjustments have been met with both support and criticism. Proponents argue that such measures are essential to prevent "carbon leakage," where industries might relocate to countries with less stringent emission regulations. However, critics, including industry leaders, caution against potential trade disputes and economic ramifications. For instance, Darren Woods, CEO of Exxon Mobil, emphasized the need for stable climate policies and expressed concerns that carbon border tariffs could introduce complexity and inefficiency, potentially leading to economic instability. He advocates for a regulatory system based on the carbon intensity of products, suggesting it would provide a more straightforward framework.

Reactions from China

China, as a major exporter to the EU and the world's largest carbon emitter, views the CBAM as a significant concern. Chinese officials and industry representatives have labeled the mechanism as a potential trade barrier that could unfairly disadvantage Chinese products in the European market. The China Iron and Steel Association, for example, described the CBAM as a "new trade barrier" and has called for more dialogues with the EU to address these concerns. Additionally, during the UN Climate Change Conference (COP28), tensions were evident as EU concerns about China's climate ambitions clashed with China's opposition to the CBAM, highlighting the challenges in coordinating global carbon policies.

Lessons from Nations with Robust Carbon Pricing Systems

Countries with established carbon pricing mechanisms offer valuable insights into designing effective and equitable climate policies:

1. **European Union Emissions Trading System (EU ETS):**
    - **Design and Implementation:** The EU ETS, as the world's largest carbon market, has undergone several reforms to address structural design flaws and ensure its effectiveness in reducing greenhouse gas emissions.
    - **Price Stability Mechanisms:** The system incorporates measures like the Market Stability Reserve to manage the supply of allowances and maintain price stability.
2. **British Columbia's Carbon Tax (Canada):**
    - **Revenue Neutrality:** Implemented in 2008, this carbon tax is designed to be revenue- neutral, with tax revenues returned to citizens through reductions in other taxes.
    - **Economic and Environmental Impact:** Studies indicate that the tax has led to a reduction in fuel consumption without harming economic growth.
3. **United Kingdom's Carbon Pricing Initiatives:**
    - **Policy Mix:** The UK has successfully combined carbon pricing with regulatory measures, such as phasing out coal-fired power plants and promoting renewable energy.
    - **Emissions Reduction:** This comprehensive approach has resulted in significant reductions in greenhouse gas emissions over the past decade.

Key Takeaways:

- **Policy Design:** Effective carbon pricing requires careful design to balance environmental goals with economic considerations. Mechanisms should include measures to prevent carbon leakage and address competitiveness concerns.

- **Stakeholder Engagement:** Gaining broad support necessitates transparent communication and involvement of all stakeholders, including industries, consumers, and policymakers.
- **Complementary Measures:** Carbon pricing should be part of a broader climate strategy that includes regulatory actions, subsidies for clean technologies, and infrastructure development.

8. WAY FORWARD FOR INDIA

India's current carbon pricing framework, with a tax rate of USD 1.6 per tonne of CO2 emissions, ranks among the lowest globally. The transition to carbon-free energy and sustainable production methods entails significant costs, both for individual industries and the Indian economy as a whole. Indian exporters face rising production expenses, declining demand in the European market, and intensified competition from EU manufacturers.

The Indian government has strongly opposed the Carbon Border Adjustment Mechanism (CBAM), labeling it a discriminatory trade barrier. This stance is shared by several developing nations, which argue that CBAM functions as a non-tariff barrier that undermines existing zero-duty Free Trade Agreements (FTAs). A key contention is that while India faces levies under CBAM, it simultaneously allows duty-free access to so- called 'green' products from the EU. The World Trade Organization (WTO) has also raised concerns about the fairness of the EU's policy, particularly given India's commitments under the Paris Agreement and its goal of achieving carbon neutrality by 2070. The imposition of a carbon tax on imports appears contradictory to the EU's and other developed nations' pledges to support the green transition in developing economies, potentially reversing the intended flow of financial assistance.

India has taken a firm stance against CBAM at the WTO and is implementing domestic measures to safeguard its interests while promoting sustainable development. These initiatives include plans to triple

renewable energy capacity by 2030 and introduce a Carbon Credit Trading System (CCTS). Given India's already substantial energy taxes, converting these levies into carbon price equivalents for CBAM-affected sectors could help mitigate the economic impact of higher trade costs.

Additionally, India could explore Free Trade Agreement negotiations with the EU and the UK, emphasizing the need for CBAM revenues to support green transitions in developing nations—aligning with the principle of "common but differentiated responsibilities" under the Paris Agreement. India could also seek to include clauses in trade agreements that delay or adjust CBAM implementation.

To further protect its interests, India is considering imposing its own carbon tax on exports to the EU, with the revenue directed toward domestic clean energy initiatives. As suggested by the Global Trade Research Initiative (GTRI), India could adopt a dual strategy: a calibrated retaliation mechanism to counterbalance EU climate taxes and the rebranding of certain existing schemes as carbon taxes. This approach could serve as a temporary solution until India's CCTS becomes fully operational. These strategic measures will enable India to navigate the challenges posed by CBAM while safeguarding key economic sectors in the short term.

9. CONCLUSION

The CBAM has the potential to drive the global transition toward low-carbon pathways. However, the EU's unilateral implementation raises concerns about insufficient consultation with trading partners and key international stakeholders. This approach suggests a shift toward a more insular policy stance, contradicting the globalization principles historically promoted by Western nations. The CBAM's effectiveness will depend on fostering international cooperation, including consensus on carbon footprint assessment methodologies and the development of robust data-sharing mechanisms.

Moreover, the unilateral nature of the CBAM risks deepening existing power imbalances. Industrialized nations, having historically contributed disproportionately to global emissions with minimal consequences, now wield significant influence over developing economies. India, in particular, has voiced concerns about the impact on its carbon-intensive industries, such as aluminum and steel. To address these challenges, a comprehensive strategy is required—one that includes trade negotiations, the establishment of a domestic Carbon Credit Trading Scheme, advocacy for fair CBAM revenue distribution, and consideration of a carbon tax on EU exports. Through these measures, India can play an active role in advancing global sustainability goals while protecting its economic interests within the bounds of international trade law

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