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Carbon Border Adjustment Mechanism

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THE ASSOCIATED CHAMBERS OF COMMERCE AND INDUSTRY OF INDIA

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Foreword

As the global community continues to confront the escalating challenges of climate change, innovative policy measures are essential to ensure that environmental objectives are achieved in a fair and effective manner. One such pioneering measure is the Carbon Border Adjustment Mechanism (CBAM), introduced by the European Union as part of its ambitious European Green Deal. Designed to prevent carbon leakage and promote sustainable industrial practices, CBAM is set to have far-reaching implications for countries worldwide, including India.

India, as a significant player in the global economy and a major exporter to the European Union, stands at a critical juncture with the implementation of CBAM. This mechanism aims to level the playing field for EU industries that are subject to stringent emissions standards by imposing a carbon price on imports from countries with less rigorous climate policies. For India, this represents both a challenge and an opportunity.

The economic impact of CBAM on India cannot be overstated. Key Indian industries, particularly those that are carbon-intensive such as steel, cement, aluminium, and fertilizers, may face increased costs, potentially affecting their competitiveness in the European market. This necessitates a strategic response from Indian businesses and policymakers alike. Indian industries will need to adapt to these new regulations, either by investing in cleaner technologies and processes or by bearing the additional costs imposed by the carbon border tax.

However, the implementation of CBAM also provides a powerful impetus for India to accelerate its transition to a low-carbon economy. By fostering innovation and encouraging the adoption of sustainable practices, CBAM can drive significant advancements in green technology and renewable energy within India. This transition, while initially challenging, offers long-term benefits including enhanced industrial resilience, reduced greenhouse gas emissions, and alignment with global sustainability goals.

Furthermore, the mechanism highlights the need for bilateral and multilateral cooperation, offering a platform for India to engage with the EU and other nations on issues of climate policy, technology transfer, and sustainable development. This transition presents an opportunity to create new jobs in emerging green sectors and to equip the workforce with the skills needed for a sustainable future.

In conclusion, the Carbon Border Adjustment Mechanism, while presenting certain challenges, also opens avenues for significant progress in India's journey towards sustainability. By embracing this opportunity to innovate, invest in green technologies, and align with global climate policies, India can not only mitigate the impacts of CBAM but also emerge as a leader in the global transition to a low-carbon future.

Deepak Sood
Secretary General
ASSOCHAM

Foreword

The adoption of the Carbon Border Adjustment Mechanism (CBAM) by the European Union (EU) represents a significant shift in global trade and environmental policy, aiming to level the playing field between EU producers and their international counterparts. India and China are projected to face substantial impacts from CBAM due to their significant exports of carbon-intensive goods to the EU. The regulation targets industries with high greenhouse gas emissions, such as steel, aluminium, cement, hydrogen, fertilisers, and electricity. Out of the same, steel and aluminium constitute a considerable portion of exports from these countries. The Indian steel sector, with its heavy reliance on the blast furnace-basic oxygen furnace (BFBoF) route, and the aluminium sector, powered largely by coalbased electricity, are particularly vulnerable. These industries have higher carbon intensities than global averages, making compliance with CBAM both challenging and costly.

The transition period ending December 31, 2025, marks the beginning of a new era when the free allocation of carbon allowances under the EU Emission Trading System (EU-ETS) will phase out and CBAM will phase in, over the subsequent eight years. This gradual shift will compel Indian exporters to either adopt cleaner production technologies or face higher carbon costs, which could erode their profit margins significantly. ICRA's analysis suggests that the initial impact of CBAM on Indian steel exporters could result in additional costs ranging at $55-65 per MT during CY2026–CY2029. However, as the free allowances phase out more rapidly during CY2030–CY2034, these costs could escalate to $90-145 per MT, representing a substantial increase of ~9-22% over current steel prices. For aluminium producers, the direct emission costs are estimated to be lower at ~3-7% of aluminium prices initially, but if indirect emissions are included in the future, the impact could be as high as ~30-33% of aluminium prices, considering that indirect emissions account for a significant portion of the total carbon footprint.

The strategic implications of CBAM for India and China extend beyond immediate financial impacts. These countries will need to innovate and invest in greener technologies to remain competitive in the EU market. For India, this involves transitioning from the BF-BoF route to more sustainable methods such as electric arc furnaces (EAFs) and integrating carbon capture, utilisation, and storage (CCUS) technologies. Similarly, the aluminium sector must increase its reliance on renewable energy sources to mitigate the risk of future indirect emission regulations.

In conclusion, the CBAM regulations underscore the urgency for Indian steel and aluminium producers to enhance their environmental performance. Aligning with global sustainability standards is not only essential for maintaining competitiveness but also crucial for the long-term viability of these sectors in a carbon-conscious global economy. This report aims to provide a comprehensive analysis of the CBAM's implications, offering insights and strategic recommendations for Indian entities navigating this new regulatory landscape

Mr. Girishkumar Kadam
Senior Vice President and Group Head
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Carbon Border Adjustment Mechanism: A Hawkeye View

BACKGROUND

The Carbon Border Adjustment Mechanism (CBAM) is an environmental policy tool designed to help the European Union (EU) achieve its climate goals of reducing greenhouse gas (GHG) emissions by at least 55% by 2030 and attaining climate neutrality by 2050.

CBAM complements the EU Emission Trading System (EU-ETS), which has recently been strengthened as part of the EU's 'Fit for 55' legislative package. The EU-ETS evolved over four phases: Phase I (2005-2007), Phase II (2008-2012), Phase III (2013-2020), and Phase IV (2021-2030). The system puts a cap on the amount of GHG emissions and accordingly, industry-specific free carbon allocations are decided by the European Commission. These annual cap/ free allowances are sequentially tightened (over the preceding year) by a predetermined percentage (known as the Linear Reduction Factor, or LRF) of the average annual baseline emissions for Phase II (2008-2012). Producers unable to keep emissions within the free allocations are required to purchase carbon receipts, thus incurring a 'carbon price' on their GHG emissions. However, producers in many non-EU countries do not face such obligations, giving them a competitive advantage and risking carbon leakage, wherein production relocates outside the EU to avoid carbon costs.

To bring in a level playing field between EU and non-EU manufacturers and avoid carbon leakage, on May 10, 2023, the EU signed the CBAM regulations. This tax will initially apply to imports from six sectors (cement, iron and steel, aluminium, fertilisers, hydrogen, and electricity). With the introduction of CBAM, free allocation will be gradually phased out and replaced by CBAM, ensuring that importers of goods from non-EU countries bear similar carbon costs for the embedded emissions of the imported goods. This approach aims to incentivise emission reductions equally between EU producers and non-EU producers exporting to the EU. CBAM targets the embedded carbon emissions of specific products imported into the EU, rather than their countries of origin.

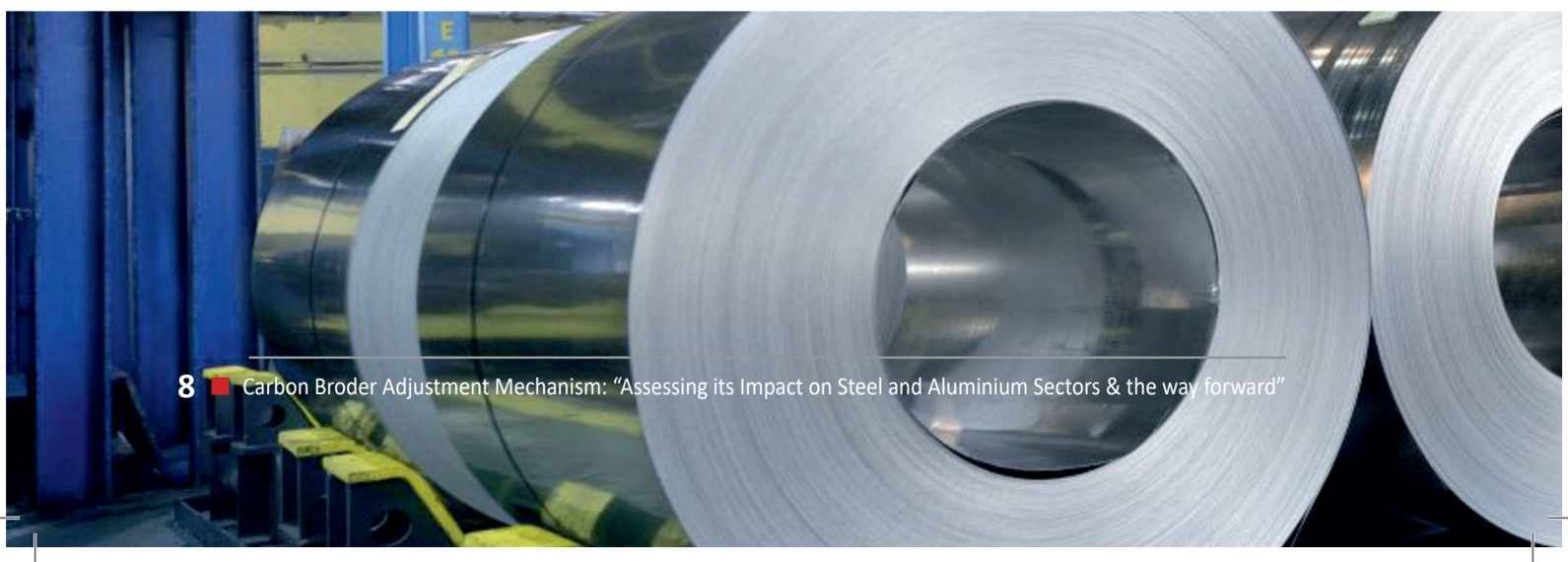
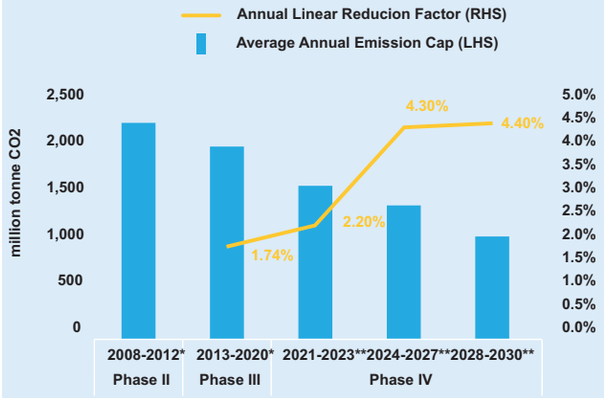


Exhibit 1

Trend in annual EU emission cap for all stationary applications (for industries like steel, cement, fertilisers)



Source: *European Commission, ICRA Research; *including the UK, **excluding the UK after Brexit*

Exhibit 2

Sectors that will be covered by the upcoming EU CBAM

Source: *ICRA Research*

With the progressive hikes of LRF for stationary applications from 1.74%–>2.2%–>4.3%–>4.4%, the benchmark free carbon allocations available to EU-based steel producers have been tightened by 3-24% in Phase IV (over Phase III), making it imperative for EU steel mills to reduce their GHG footprint or pay a hefty carbon price. However, in case of aluminium, the benchmark free carbon allocations available to EU-based primary aluminium producers is already close to the minimum range (~3-5% further reduction) reflecting limited scope of further technological advancement in the process emission. The heat and fuel consumption benchmarks, which apply to all sectors, have seen a sharp reduction as the reference fuel has been changed from natural gas to biomass.

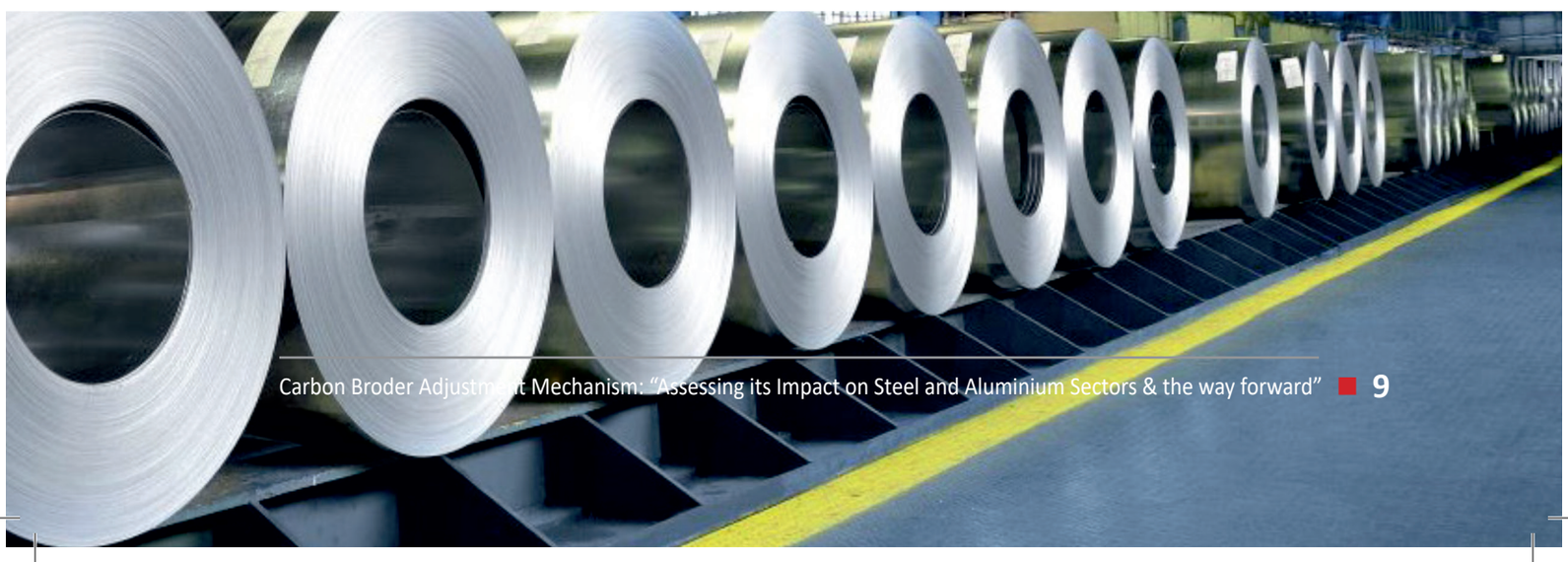


Exhibit 3

Benchmark free carbon allocations available to EU-based steel producers

Particulars	2013-2020 (Phase III)	2021-2025 (Phase IV)	% Change
Coke	286	217	-24%
Sinter	171	157	-8%
Hot metal	1,328	1,288	-3%
EAF carbon steel	283	215	-24%
EAF high alloy steel	352	268	-24%

Source: *EUROFER, European Commission, ICRA Research; igures in kg CO2/ MT of intermediate product; benchmarks based on the performance of the 10% best installations covered by the EU-ETS*

Exhibit 4

Benchmark free carbon allocations available to EU-based primary aluminium producers

Particulars	2013-2020 (Phase III)	2021-2025 (Phase IV)	% Change
Electrolysis	1.514	1.443	-4.7%
Anode production	0.324	0.312	-3.7%
Heat consumption	62.3	47.3	-24.1%
Fuel consumption	56.1	42.6	-24.1%

Source: *European Aluminium, European Commission, ICRA Research; igures in tCO2/ MT of intermediate product and tCO2/ tera joule for heat and fuel consumption; benchmarks based on the performance of the 10% best installations covered by the EU-ETS*

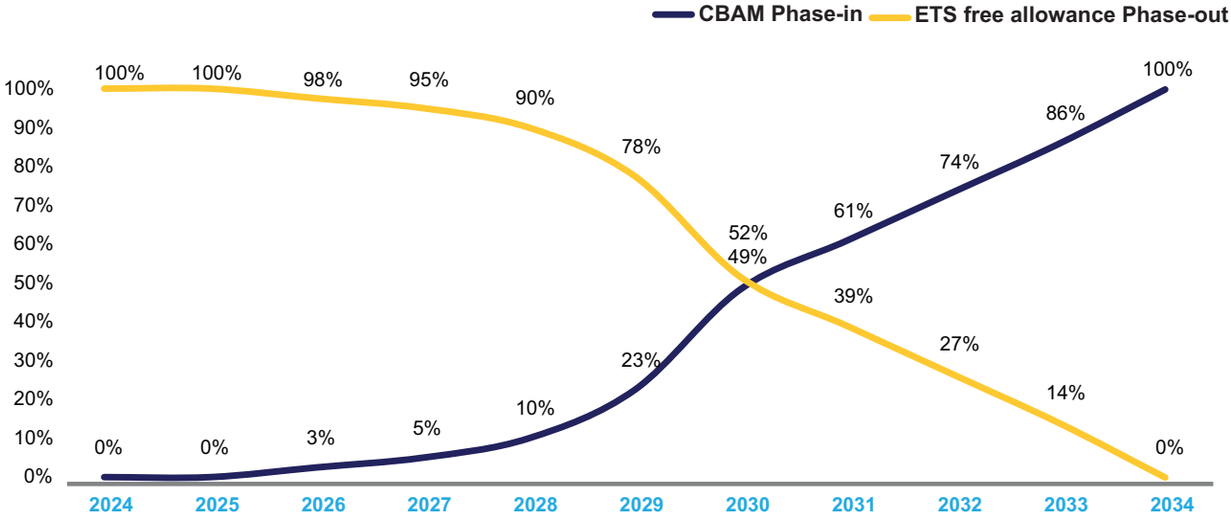
The CBAM will be introduced in the following phases:

Transitional period (October 1, 2023 to December 31, 2025): In CBAM's 'Transitional Phase', the focus will be on the reporting of embedded carbon, but without any financial adjustment for EU importers. During this period, exporters to the EU will have to report their scope 1 emissions but are not liable to pay taxes. However, penalties may be imposed, for example, for failing to submit the required quarterly CBAM reports.

Definitive period (from January 1, 2026): From January 1, 2026, EU importers will have to buy CBAM certificates, corresponding to the embedded emissions above the EU-ETS benchmark, whose price will be linked to the weekly average carbon prices at the EU-ETS. However, during 2026–2033, the CBAM obligation will gradually cover the embedded emissions of CBAM goods, while the free allocation under the EU-ETS will progressively phased out. Starting from 2034, 100% of the embedded emissions of CBAM goods will be covered by CBAM certificates, and no free allocation will be provided under the EU-ETS for these goods.

Exhibit 5

Pathway for phasing out free allowances and phasing in CBAM regulations



Source: *European Commission; ICRA Research*

In addition, during the transitional phase, both direct and indirect emissions for all goods falling under the scope of CBAM are to be monitored and reported. During the definitive phase, however, the CBAM scope will be limited to direct emissions for iron/steel, aluminium and hydrogen, while importers of cement and fertilisers will have to declare both direct and indirect emissions. Non-inclusion of indirect emission in the aluminium sector is likely to limit the impact of the regulations on domestic aluminium entities. Direct emissions cover the emissions generated during the production processes of CBAM goods, including from the heating and cooling stages of production, irrespective of the location of these processes. Indirect emissions cover the production of electricity consumed during the production of CBAM goods, regardless of the location of the production of the consumed electricity.

Overall, the CBAM regulations are a policy tool to address carbon leakage and ensure that imported goods are subject to the same carbon costs as goods produced within the EU. The mechanism is expected to increase costs, making it less attractive compared to EU-produced goods and potentially goods manufactured by countries with lower carbon footprints. Beyond the direct economic implications, CBAM also poses significant strategic challenges for the impacted sectors.

One major challenge is the need for technological adaptation. To mitigate the impact of CBAM, the producers will need to adopt cleaner and more efficient technologies. Additionally, CBAM may drive changes in global trade dynamics. With the EU becoming a less viable market due to increased costs, the exporting countries may seek alternative markets with less stringent carbon regulations. This shift could lead to changes in trade routes and partnerships, potentially opening new opportunities but also requiring significant adjustments in export strategies. Nonetheless, it also presents an opportunity to innovate and adopt sustainable practices to navigate the impacts of CBAM and maintain its competitiveness in the global market.

Impact of CBAM on Major Global Regions

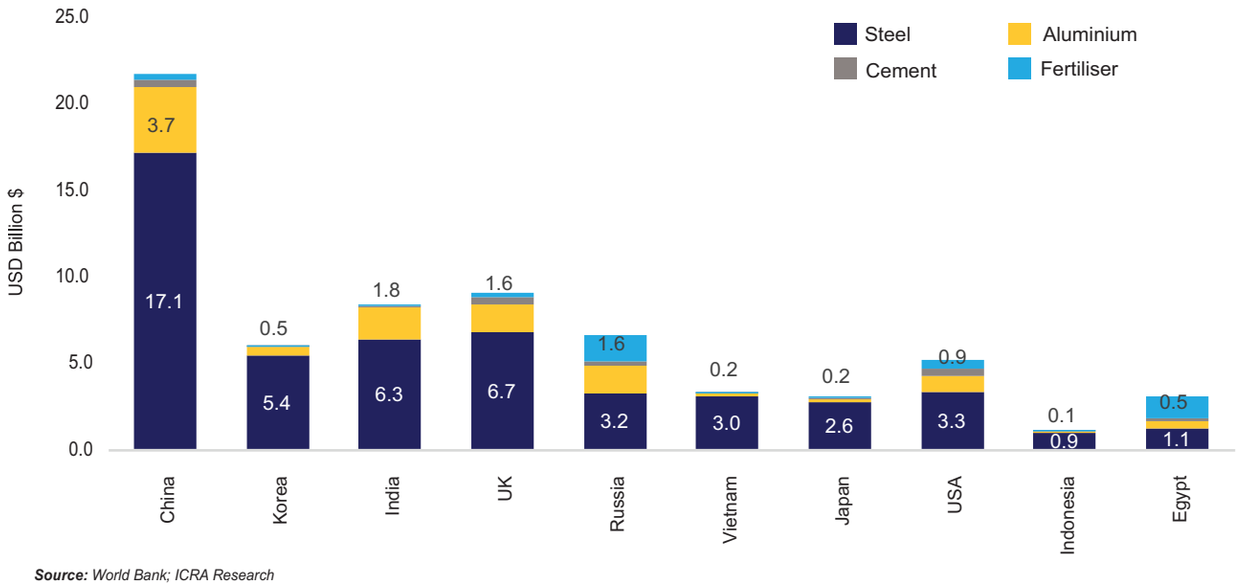
INDIA AND CHINA EXPECTED TO BE THE MOST AFFECTED BY CBAM-COVERED GOODS

The implementation of CBAM will significantly impact various regions worldwide, especially those that rely heavily on exporting carbon-intensive goods to the EU. Initially, the regulation targets industries with high GHG emissions, such as steel, aluminium, cement, fertilisers, and electricity. In these sectors, the major exporters to the EU include China and India, accounting for approximately ~18% and ~7%, respectively, of CBAM-covered goods.

China, as the world's largest producer and exporter of steel and aluminium, will be profoundly affected by CBAM. The country's industrial processes are heavily dependent on coal, leading to high carbon emissions. With the introduction of CBAM, the cost of exporting these goods to the EU will increase, reducing its competitiveness in the market. Similarly, India, another major exporter of steel and aluminium, will face significant challenges due to its reliance on carbon-intensive production methods. The Indian steel sector, particularly producers using the BF-BoF route, has a higher carbon intensity than the global average.

Exhibit 6

Benchmark free carbon allocations available to EU-based primary aluminium producers



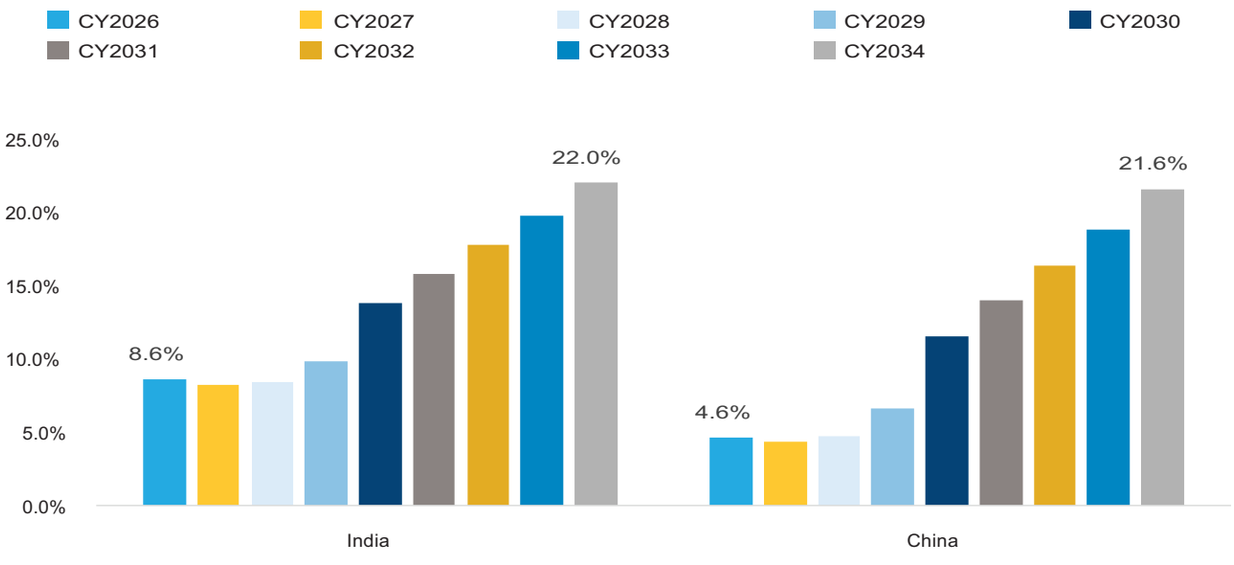
Source: *World Bank; ICRA Research*

Among the sectors impacted by the CBAM, steel and aluminium will be the most significantly affected, accounting for ~66% and ~23%, respectively, of the overall exports of CBAM-covered goods to the EU. India and China are poised to be the most adversely impacted by these regulations. Specifically, steel exports to the EU constitute ~29% of India's total steel exports and ~10% of China's. In the aluminium sector, exports to the EU account for roughly 25% of India's total aluminium exports compared to ~11% of China's total aluminium exports. Consequently, the impact on India is likely to be more pronounced than on any other trading partner, due to its higher dependency on the EU market for these goods.

Other goods, such as cement, fertilisers, hydrogen, and electricity, make up a nominal share of the total exports to the EU. As a result, the impact on these sectors is expected to be negligible.

Exhibit 7

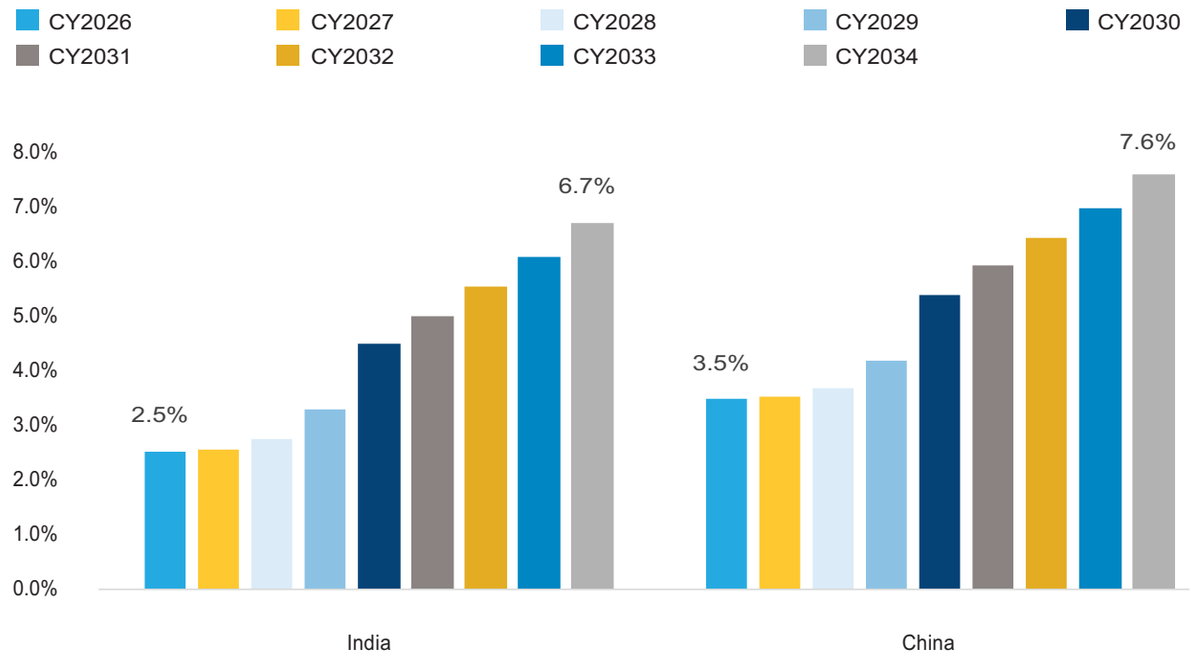
CBAM impact (% current steel prices) on steel export from India and China to the EU



Source: *ICRA Research*

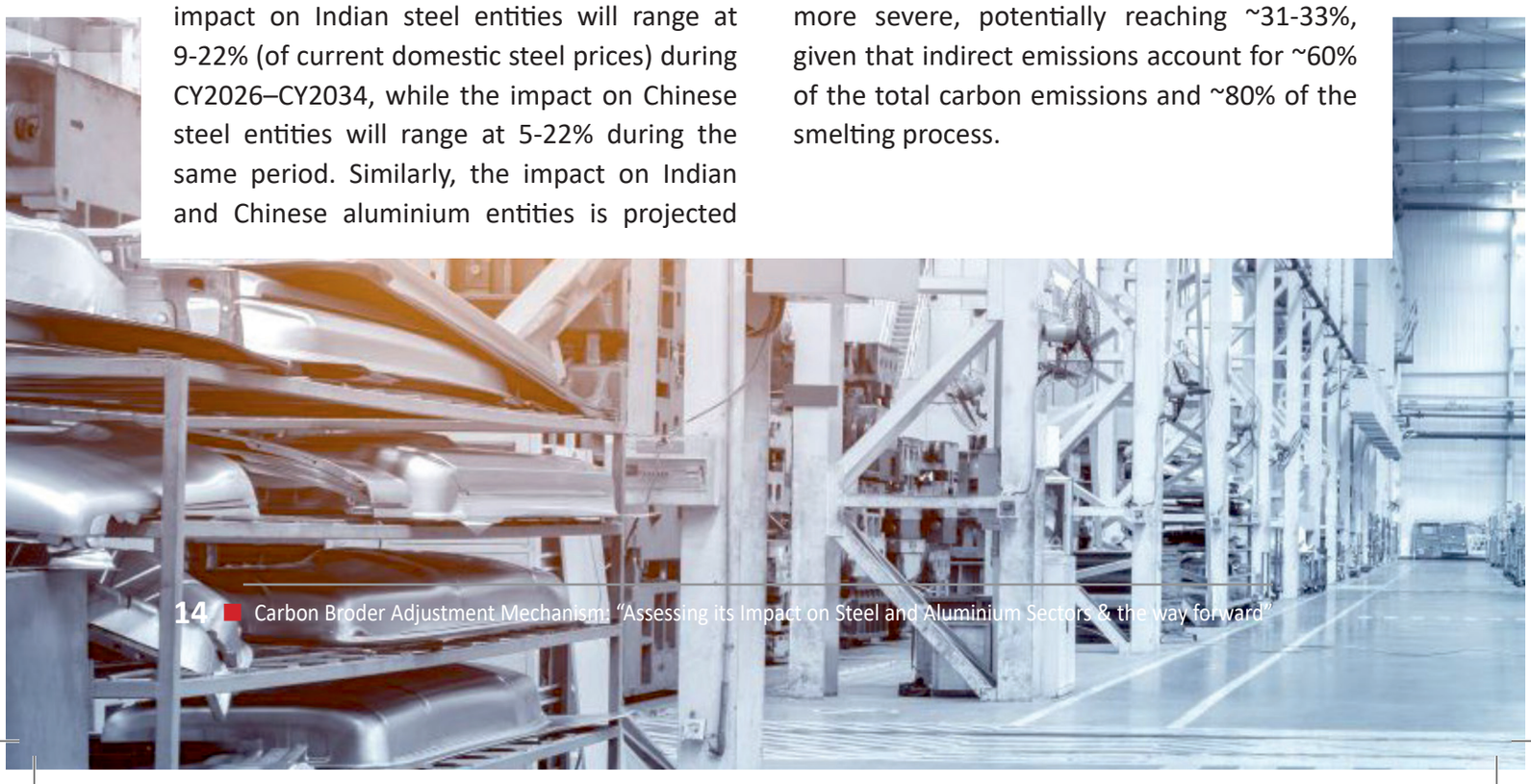
Exhibit 8

CBAM impact (% of current aluminium prices) on aluminium export from India and China to the EU



Source: *ICRA Research*

As evident from Exhibits 7 and 8, the regulations are expected to have significant implications for India and China, affecting the profitability of major exporters to the EU from these countries. According to ICRA's estimates, the impact on Indian steel entities will range at 9-22% (of current domestic steel prices) during CY2026–CY2034, while the impact on Chinese steel entities will range at 5-22% during the same period. Similarly, the impact on Indian and Chinese aluminium entities is projected to be 3-7% and 4-8%, respectively, over this period. It is important to note that the current impact on aluminium entities includes only direct emissions. If indirect emissions are also covered in the future, the impact would be more severe, potentially reaching ~31-33%, given that indirect emissions account for ~60% of the total carbon emissions and ~80% of the smelting process.



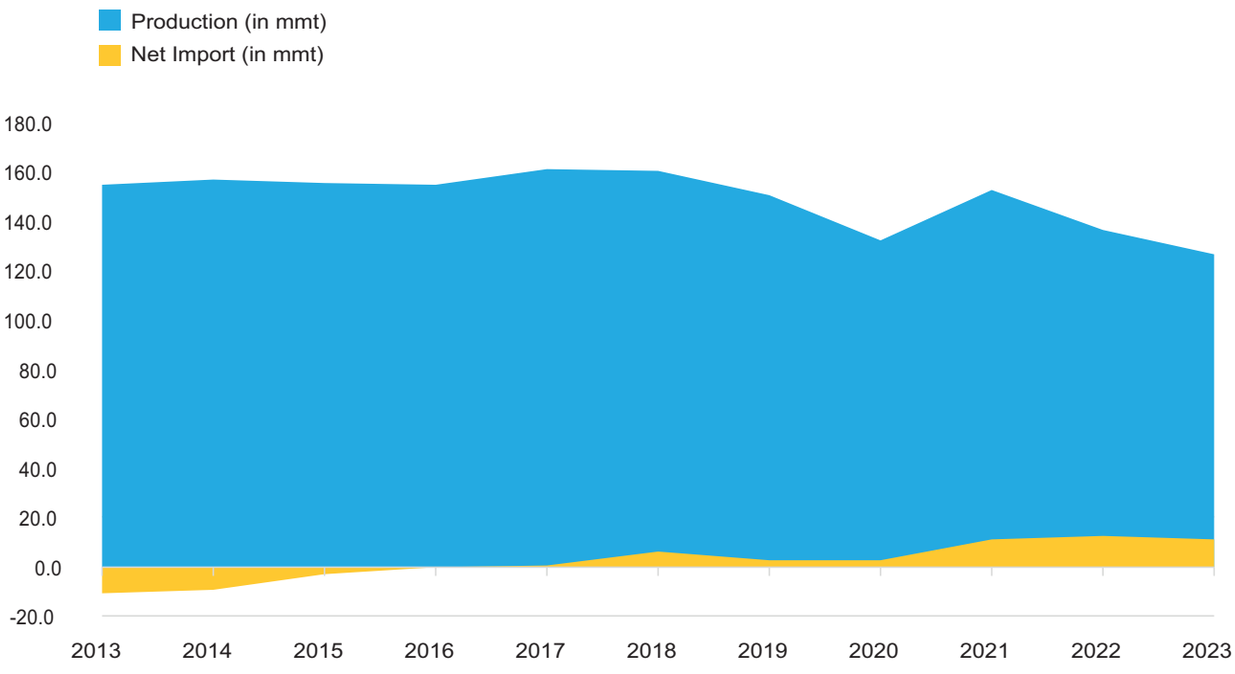
Steel Industry Analysis: Implications of CBAM Regulations

The EU's CBAM aims to address carbon leakage by imposing a carbon cost on imports from countries with less stringent climate policies, significantly impacting India's steel sector. As one of the world's largest steel producers and exporters, India faces considerable challenges from the high carbon intensity of its steel production, which relies heavily on coal. CBAM requires Indian steel exporters to the EU to pay for the carbon emissions embedded in their products, leading to increased export costs that could reduce their competitiveness in the EU market. As per ICRA's estimates, the CBAM compliance requirements could pull down the profits of Indian steel exports to EU by $55-145/MT between CY2026 and CY2034 (~9-22% of domestic steel prices), thus negatively impacting the margins of steel producers. For this analysis, ICRA has assumed that carbon price in the EU will remain at €74/MT CO2 (based on average carbon price of last three years).

Leading domestic primary steel producers have an average CO2 emission intensity of around 2.6 MT CO2/MT crude steel. This is ~12% higher than the global average CO2 intensity for the BF-BoF route. Europe has historically remained an important overseas destination for Indian steel mills, accounting for ~29-30% of India's annual steel exports. However, the carbon footprint of Indian mills is significantly higher than competing suppliers to the EU. For instance, the average emission intensity of South Korean producers is 1.6 MT CO2/MT crude steel. Similarly, with two-third of Turkey's crude steel production being through the electrical route using scrap, it has a carbon footprint of only 1 MT CO2/MT crude steel. Therefore, unless the carbon footprint of Indian steel mills is brought at par with global standards, it can potentially lead to lower profits and a loss of market share in Europe for domestic producers

Exhibit 9

Trend in EU's steel consumption by source



Source: *Eurofer, ICRA Research*

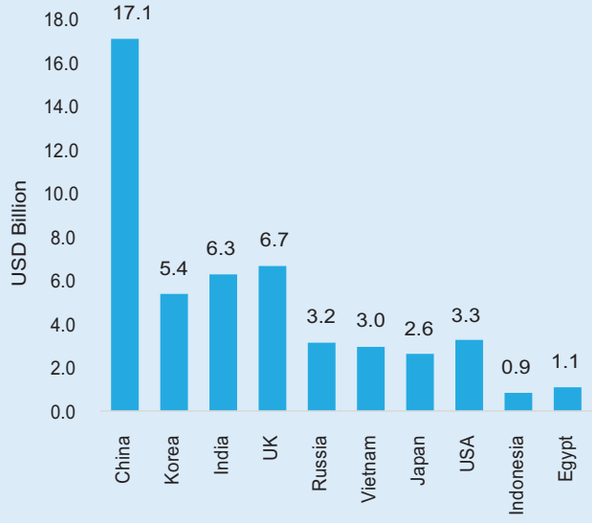
Considering the trend in the EU's steel consumption, import dependence has significantly increased over the years due to a variety of challenges faced by EU's domestic steel producers. This shift in dynamics has led the EU to transition from a net exporter to a net importer of steel from 2017, reflecting the region's growing dependency on external sources to meet its steel consumption needs.

The dollar traded value indicates that China ($17.1 billion in CY2023) and India ($6.3 billion) are the primary countries with significant exposure to the EU market for steel exports covered under CBAM. Although this trade accounts for only ~10% of China's total steel exports, it represents a substantial ~29% of India's total steel exports. Consequently, India's steel sector is more heavily reliant on the EU market compared to China. This dependency highlights that India is more vulnerable to regulatory changes like CBAM, which could significantly impact its steel export revenues and market dynamics.

Beyond China and India, some of the other large steel exporters to the EU are from Russia, South Korea, the UK, Vietnam, USA and Japan. While the CBAM framework is unlikely to materially impact India's trade flows immediately, the prospect of incidence of a large carbon tax from Q4 FY2027 can incentivise EU importers to shift towards steel producers, having a low carbon footprint, much ahead of the outer deadline. Therefore, unless Indian mills can materially bring down their carbon footprint during the transition period, it can potentially lead to lower profits and a loss of market share in Europe.

Exhibit 10

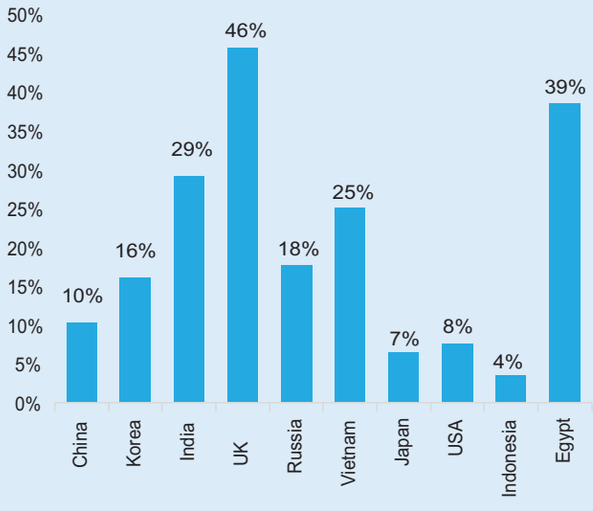
Country-wise export to the EU (in CY2023)



Source: *World Bank data, ICRA Research*

Exhibit 11

EU's steel export as % of total steel export

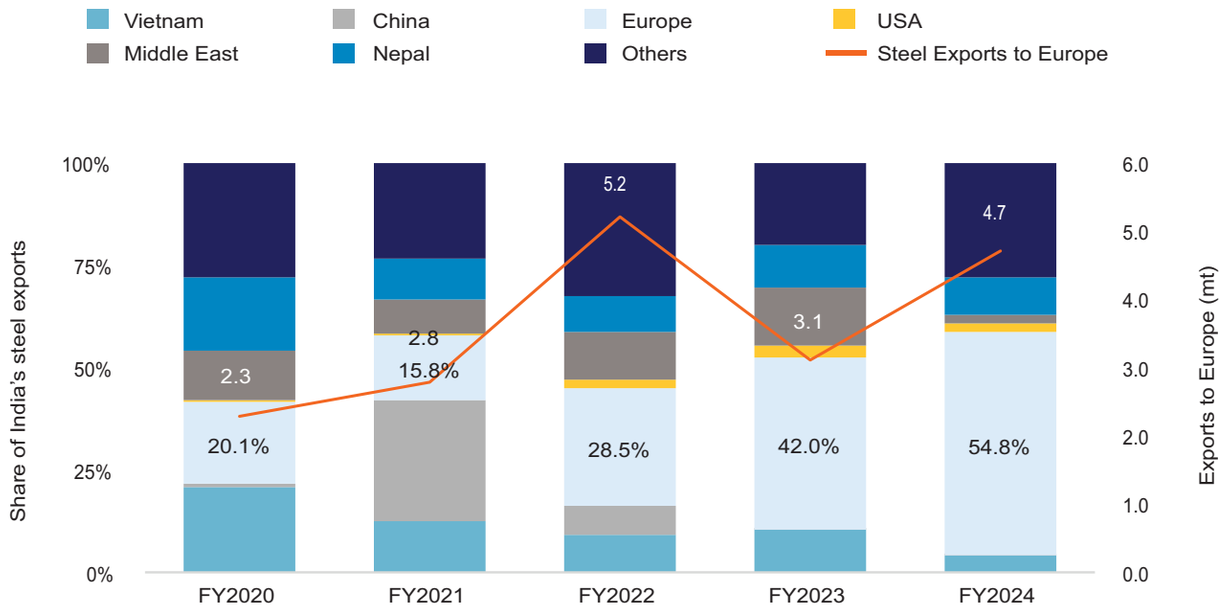


Source: *World Bank data, ICRA Research*

CBAM could impact ~15-40% of India's annual steel exports, (in volume), which are earmarked for Europe, unless India seeks relief at the World Trade Organisation (WTO). Share of steel exports from India to Europe has been steadily increasing over the years from 15-20% of overall exports in FY2020–FY2021 (~2-3 MT annually), moving up to ~30- 40% in FY2022–FY2023 (~3.5-5 MT annually). In FY2024, it has further increased to ~55%. With European steel prices generally trading at a premium to Asian prices, Europe has historically remained an important export destination for Indian steel mills with top buyers being from Belgium and Italy. Apart from CBAM, the EU also has country-specific quotas for annual steel import volumes, which acts as a protection against dumping by overseas producers.

Exhibit 12

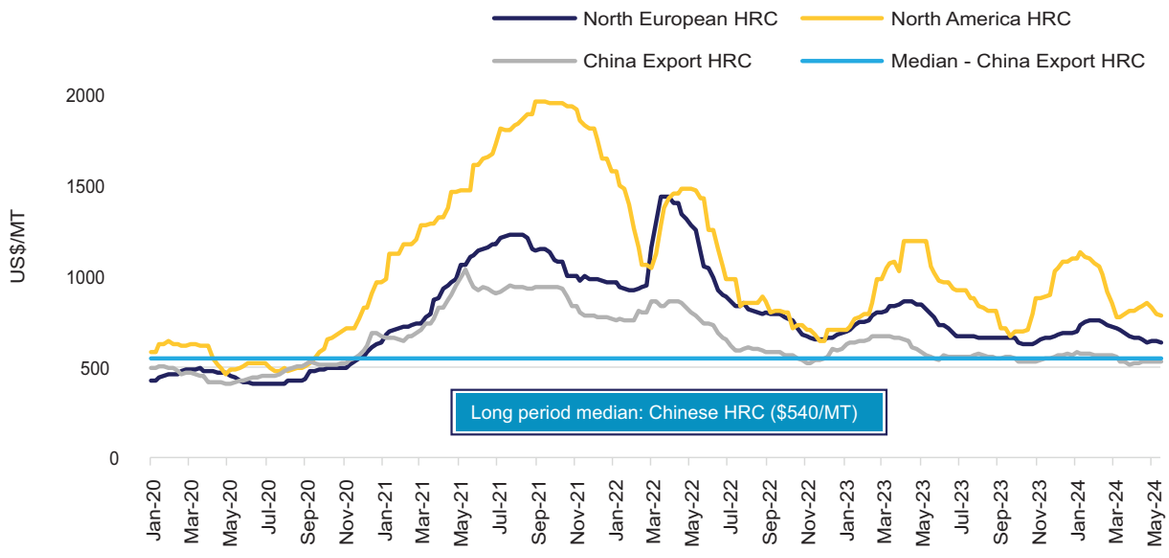
Country-wise share of India's steel (finished+semis) exports



Source: *Ministry of Commerce and Industry, ICRA Research*

Exhibit 13

Trend in Hot Rolled Coil (HRC) prices in key geographies / countries



Source: *Bloomberg, ICRA Research*

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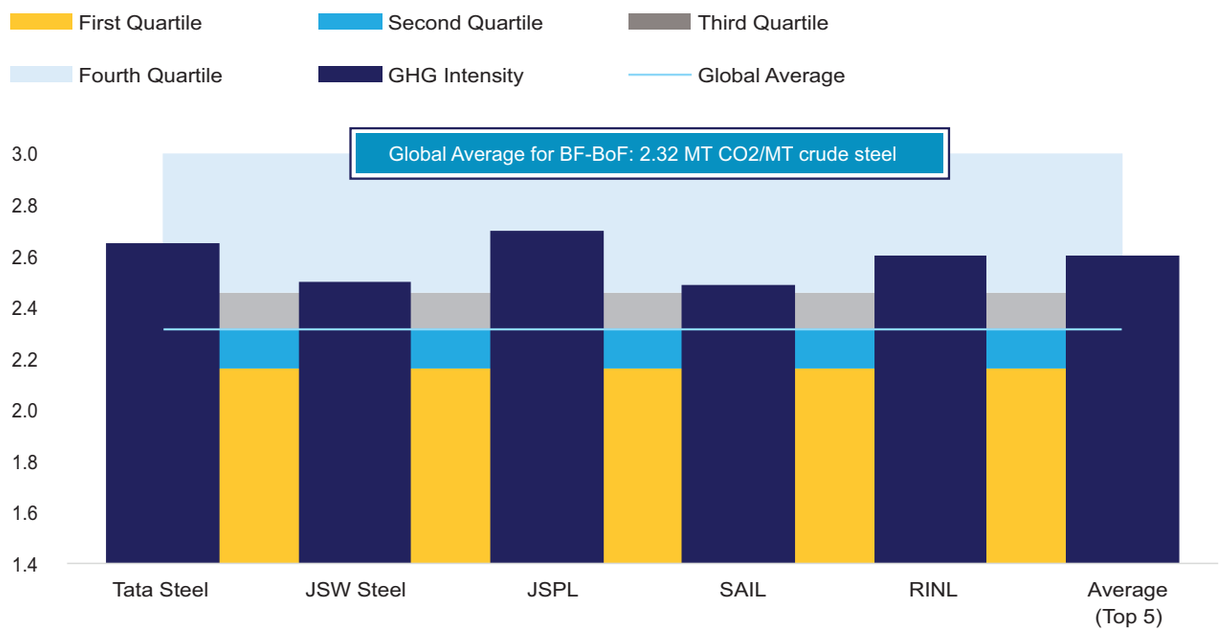
MEASURING UP CARBON FOOTPRINT

In steelmaking, the GHG intensity of the BF-BoF route is the highest among all production methods. This route, due to its operating cost competitiveness and capability to produce steel for high-end applications, emerged as the dominant choice for large Indian steel players, accounting for ~45% of India's domestic crude steel production. The top five primary steel producers in India — Tata Steel, JSW Steel, SAIL, Jindal Steel & Power, and RINL — have an average CO2 emission intensity of ~2.6 MT CO2/MT crude steel (including scope 1 and 2 emissions). This figure is 12% higher than the global average GHG intensity for the BFBoF route, which stands at 2.32 MT CO2/MT crude steel. This disparity places Indian primary steel producers in the fourth quartile of the global CO2 emission curve for the BFBoF steelmaking process.

For all steelmaking routes, the global average GHG intensity is 1.91 MT CO2/MT crude steel (including scope 1 and 2 emissions), indicating that the top five domestic primary steel producers have a GHG intensity that is ~36% higher than the global average. Consequently, addressing these emissions is crucial for Indian steelmakers to improve their environmental performance and align with global sustainability standards

Exhibit 14

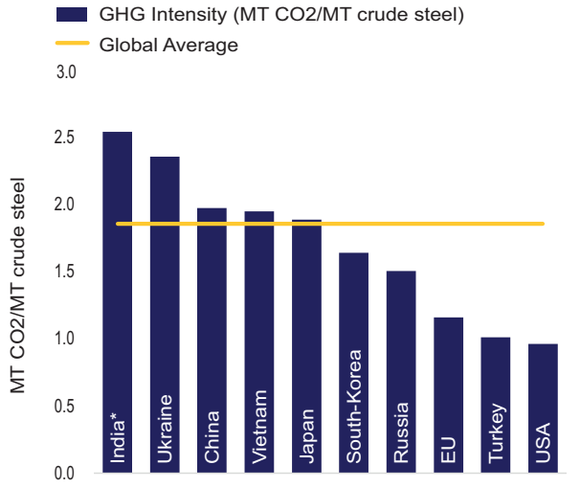
GHG emission intensity of large domestic BF-BoF based steel producers



Source: *World Steel Association, Cleveland Clifs, Company reports, ICRA Research; The Quartiles are for the BF-BoF route of steelmaking; GHG intensity for Tata Steel, JSW Steel, and JSPL for Indian operations*

Exhibit 15

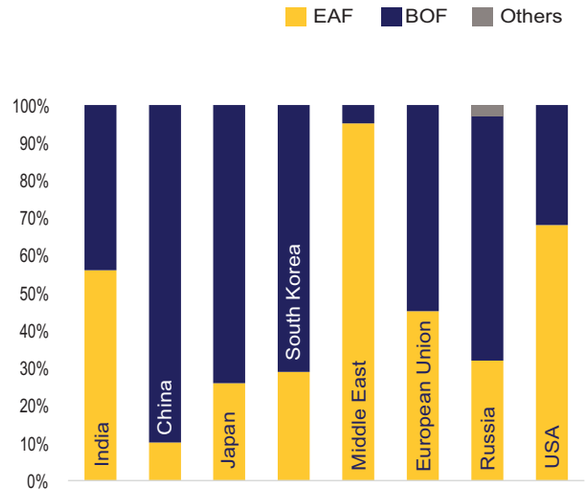
GHG emission intensity (scopes 1 + 2) of key steel supplying countries



Source: *World Steel Association, Report titled, Steel Climate Impact: An International Benchmarking of Energy and CO2 Intensities, ICRA Research; *India data includes the average of top 5 primary producers*

Exhibit 16

Steel production (route-wise) in various countries



Source: *World Steel Association, ICRA Research*

While India has a significant share of Electric Arc Furnace (EAF) capacities, a substantial portion is utilised through the EAF-Induction Furnace (EAF-IF) route. In this process, sponge iron produced in rotary kilns is used as feedstock in EAFs. Consequently, despite the presence of EAF technology, the emission intensity remains high due to the carbon-intensive nature of sponge iron production.

The high GHG intensity in Indian steel production underscores the need for significant technological advancements and the adoption of cleaner production methods. Transitioning to less carbon-intensive steelmaking processes, increasing energy efficiency, and integrating renewable energy sources are essential strategies for reducing the carbon footprint. As the global steel industry moves towards more sustainable practices, Indian steel producers must adapt to remain viable in an increasingly carbon-conscious market. The EU's CBAM further emphasises the need for these changes, as it will impact India's steel exports to the EU, highlighting the strategic importance of sustainability in maintaining global market competitiveness.

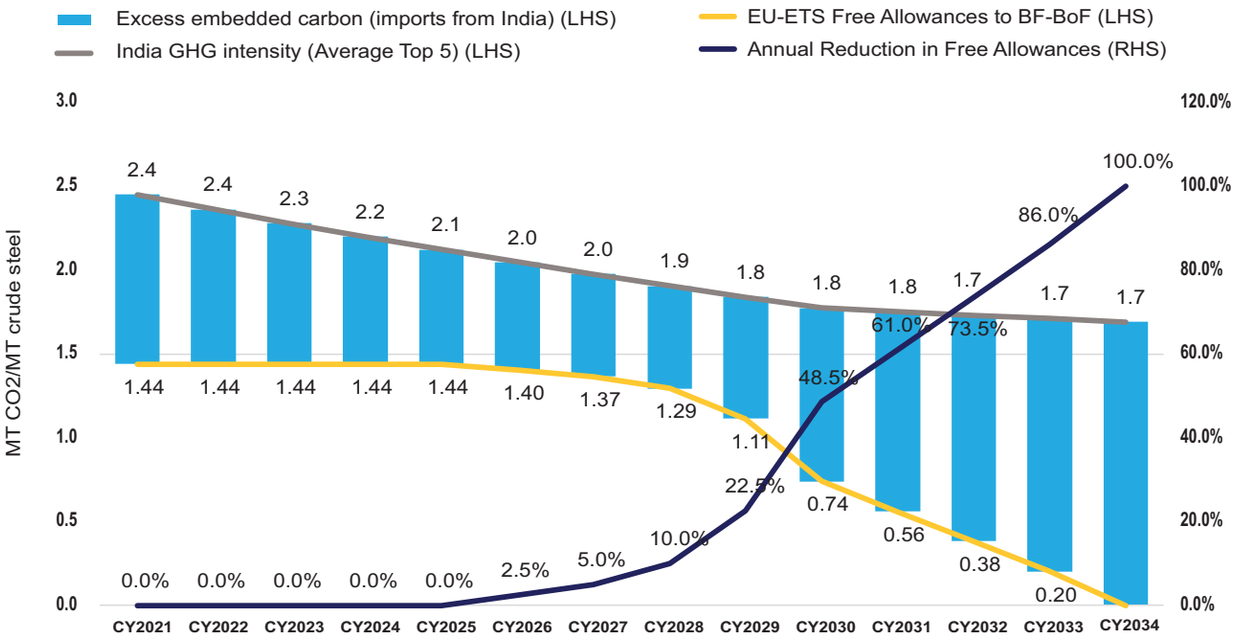
COUNTING THE COSTS

After the transition period ends on December 31, 2025, the phasing-out of free allocation under the EU-ETS will occur in parallel with the phasing-in of the CBAM over the subsequent eight years (CY2026-CY2034). This gradual shift marks a significant regulatory change aimed at reducing carbon emissions across industries.

Currently, the EU-ETS free allocations benchmark for the BF-BoF route stands at ~1.4 MT CO2/MT crude steel (only scope 1 emissions). This benchmark is considerably lower than the average scope 1 emission intensity of leading domestic BF-BoF-based steelmakers in India, which is around 2.45 MT CO2/MT crude steel. As the free allocation phase-out progresses, the excess embedded emissions are expected to peak in CY2034.

Exhibit 17

Trend in EU-ETS free allowance for an EU steel mill vs. average GHG emission intensity (scope 1) of leading Indian players for BF-BoF production route

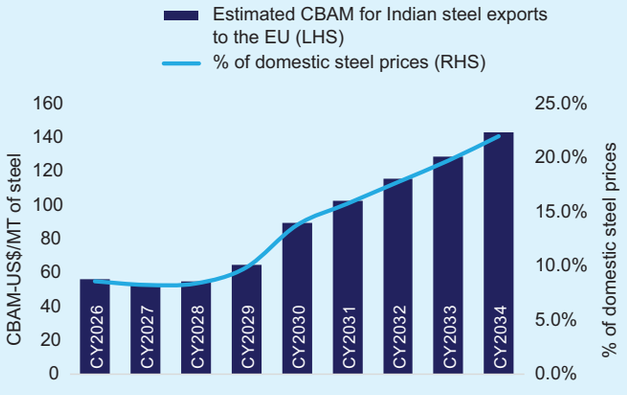


Source: *European Commission, Company announcements, ICRA Research; trajectory of reduction in GHG intensity for Indian mills is estimated on the basis of company guidance*

Exhibit 18

Estimated CBAM for Indian steel exports to the EU

ICRA's analysis suggests that given the modest pace of the proposed reduction in free allocations between CY2026 and CY2029, the taxes emanating from CBAM for EU exports by domestic primary steel producers is expected to remain in the range of $55-65/MT, which would weigh down on entity profits. However, as the pace of phasing out of free allowances picks up thereafter, the incidence of taxes arising from CBAM is expected to significantly increase to $90-145/MT between CY2030 and CY2034. Consequently, the impact of CBAM will be substantial, potentially affecting 9-22% of current steel prices, thereby imposing a considerable financial strain on steel exporters to the EU.



Source: *ICRA Research; price of carbon assumed constant at €74/MT ($80/MT)*

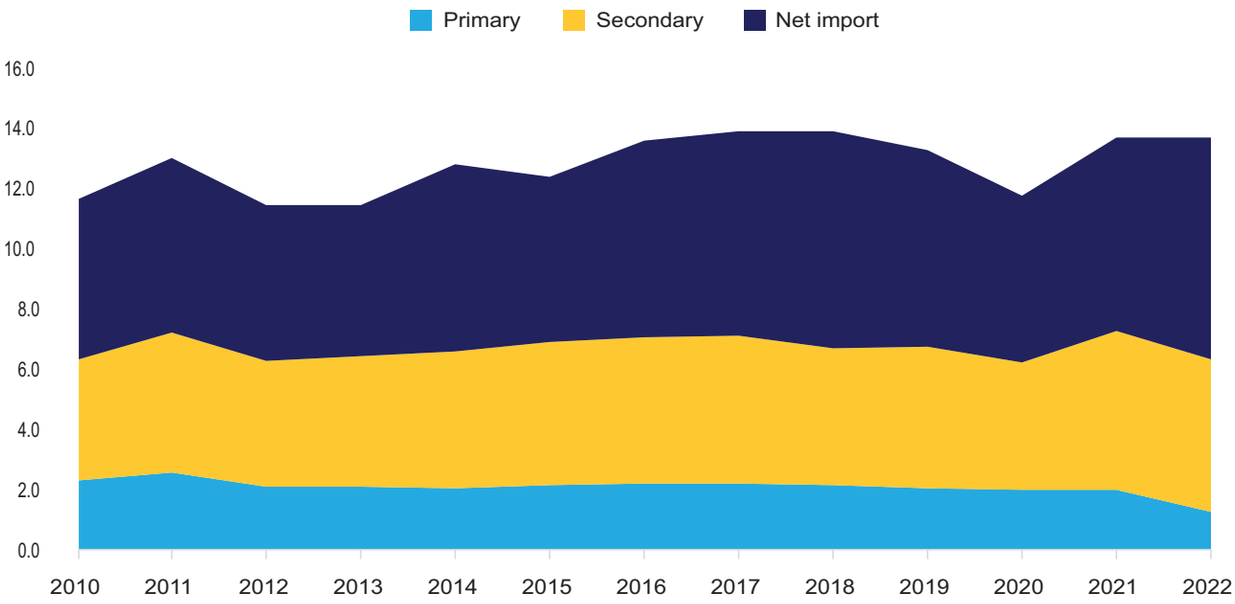
Aluminium Sector: Navigating the CBAM Challenge

The CBAM ruling on exports to the EU will have a limited impact on the domestic primary aluminium producers. This is because the present notification covers the financial impact w.e.f. January 1, 2026, only on direct process-related emission, while excluding the indirect emission, which generates ~80% of the total emissions in the primary aluminium smelting process. The indirect emission primarily results from the production of electricity that is subsequently consumed in the smelting process, irrespective of whether it was produced within the installation or imported from outside. The carbon tax impact is likely to remain in the range of $60-160/MT from CY2026 to CY2034, which would be ~3-7% of the current aluminium prices. However, in case the indirect emission is also included in future, the impact would be severe, equivalent to ~30-33% of the current aluminium prices, as domestic entities are significantly dependent on the coal-fired power plant for sourcing electricity.

Considering the trend in the EU's aluminium consumption, import dependence has significantly increased over the years due to the challenges faced by their primary aluminium producers. As a result, net aluminium imports have risen to 7.3 million metric tonne (MMT) in CY2022, over approximately 5.0 MMT in CY2010. Consequently, the regulation will raise the cost of aluminium entering the EU unless non-EU producers adopt low-emission processes.

Exhibit 19

Trend in EU's aluminium consumption by source



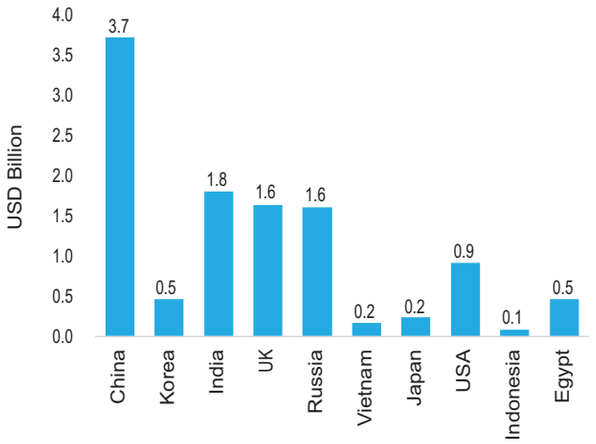
Source: *European Aluminium, ICRA Research*

The dollar traded value shows that China ($3.7 billion in CY2023) and India ($1.8 billion) are the leading countries with substantial exposure to the EU market for aluminium exports covered under CBAM. While this trade accounts for only ~11% of China's total aluminium exports, it represents ~25% of India's total aluminium exports. As a result, compared to China, a higher share of India's aluminium exports are directed to the EU. This indicates that India's aluminium sector is more reliant on the EU market, making it more susceptible to regulatory changes like CBAM. This differential impact may compel India to accelerate its adoption of low-emission technologies and renewable energy integration to maintain its competitiveness.

Beyond China and India, other significant exporters to the EU include Russia, the UK, USA and South Korea, each of which has a substantial share of aluminium exports heading to the EU. These countries will also need to address the challenges posed by CBAM to maintain their competitiveness in the EU market.

Exhibit 20

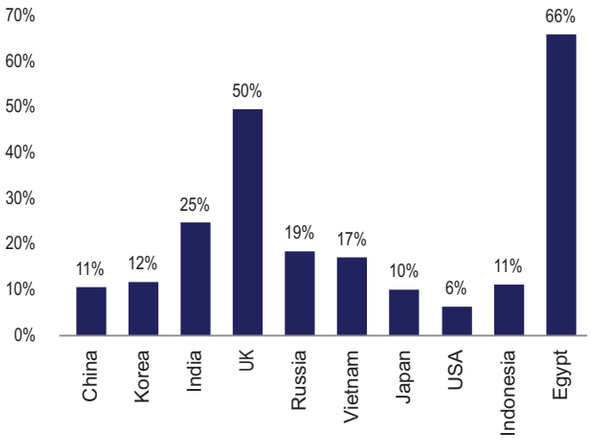
Country-wise export to the EU (in CY2023)



Source: *World Bank data, ICRA Research*

Exhibit 21

EU's aluminium export as % of total aluminium export



Source: *World Bank data, ICRA Research*

CBAM could impact ~15-25% of India's annual aluminium exports, which are shipped to Europe. With European premium generally higher than the Asian premium, Europe has remained an important export destination for aluminium players with top buyers being Greece, Italy and the Netherlands. Notably, the share of Indian trade has gradually increased over the years, corresponding with a decline in primary aluminium production in Europe. Moreover, the higher dependency on the European market could mean that any regulatory changes in the EU have a disproportionate impact on Indian aluminium exports compared to other markets.

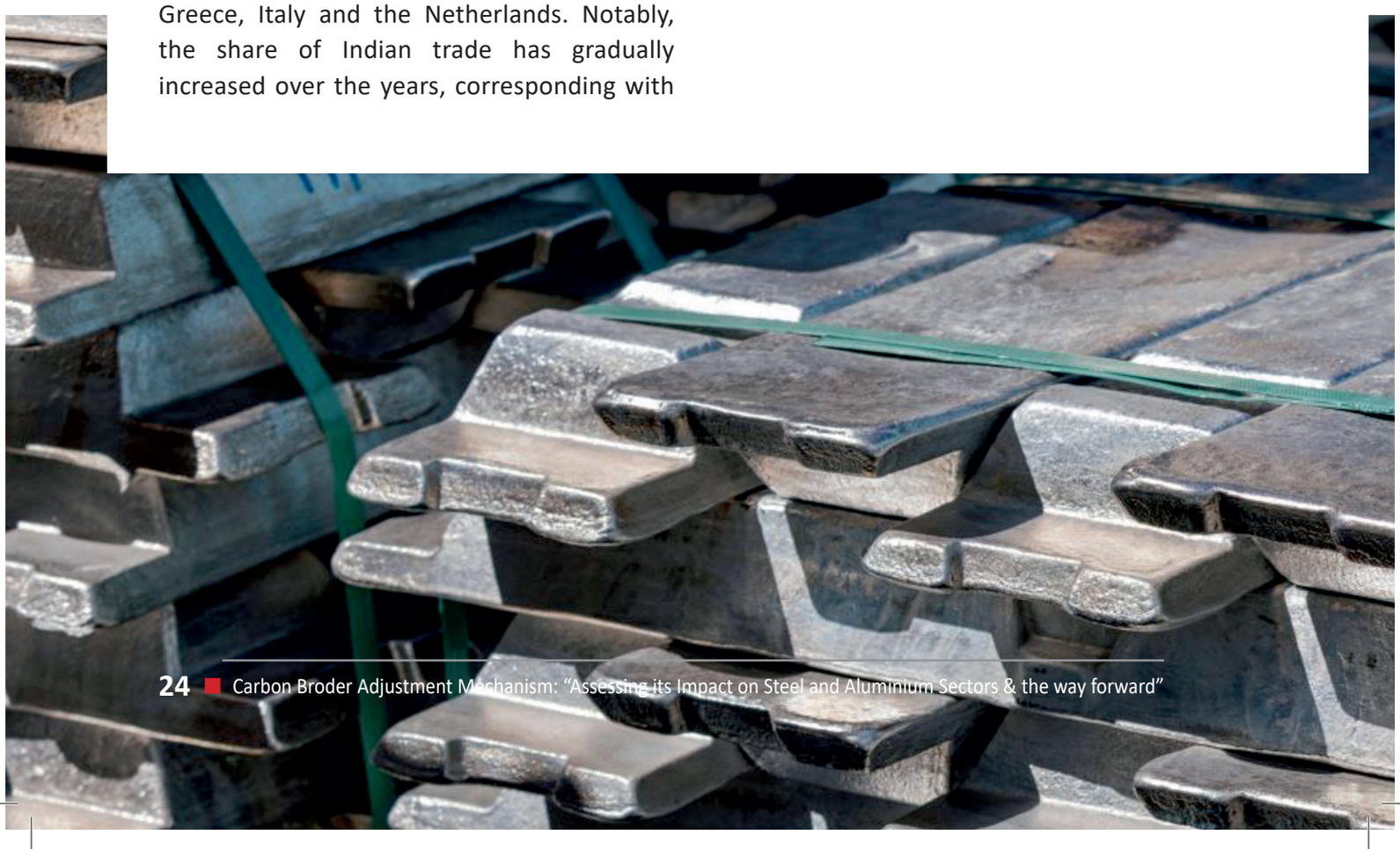
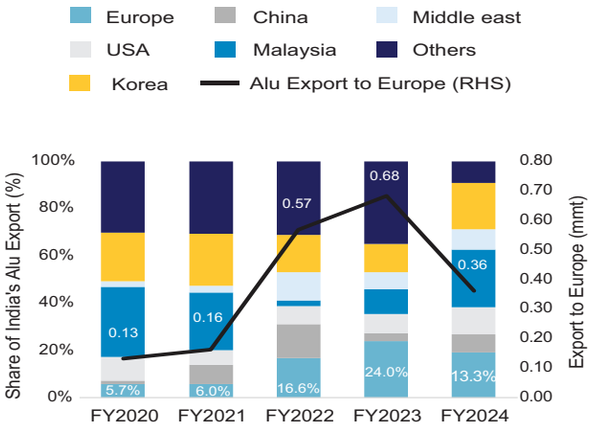


Exhibit 22

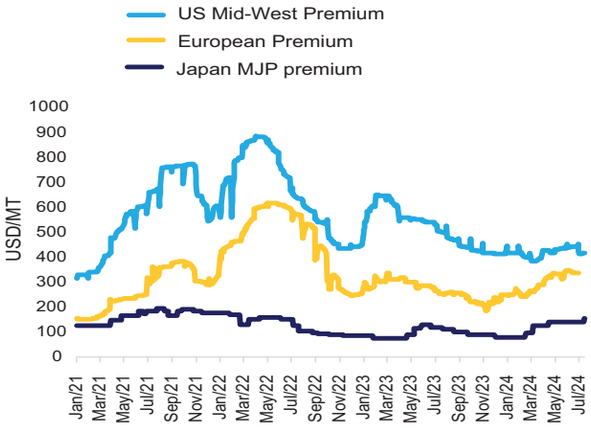
Country-wise share of India's aluminium exports



Source: *Ministry of Commerce and Industry; ICRA Research*

Exhibit 23

Trend in market premium in key geographies/ countries

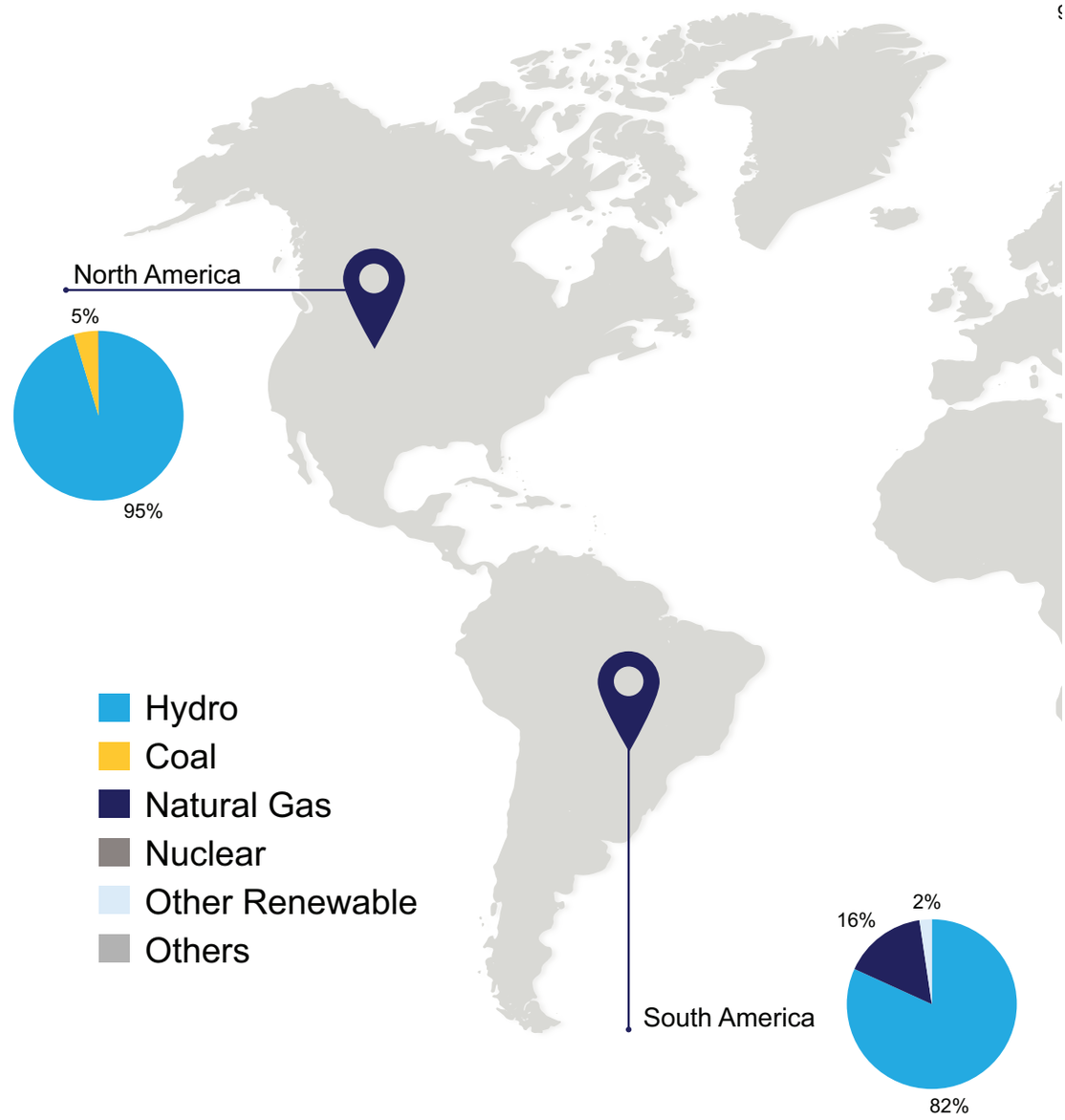


Source: *Bloomberg, ICRA Research*

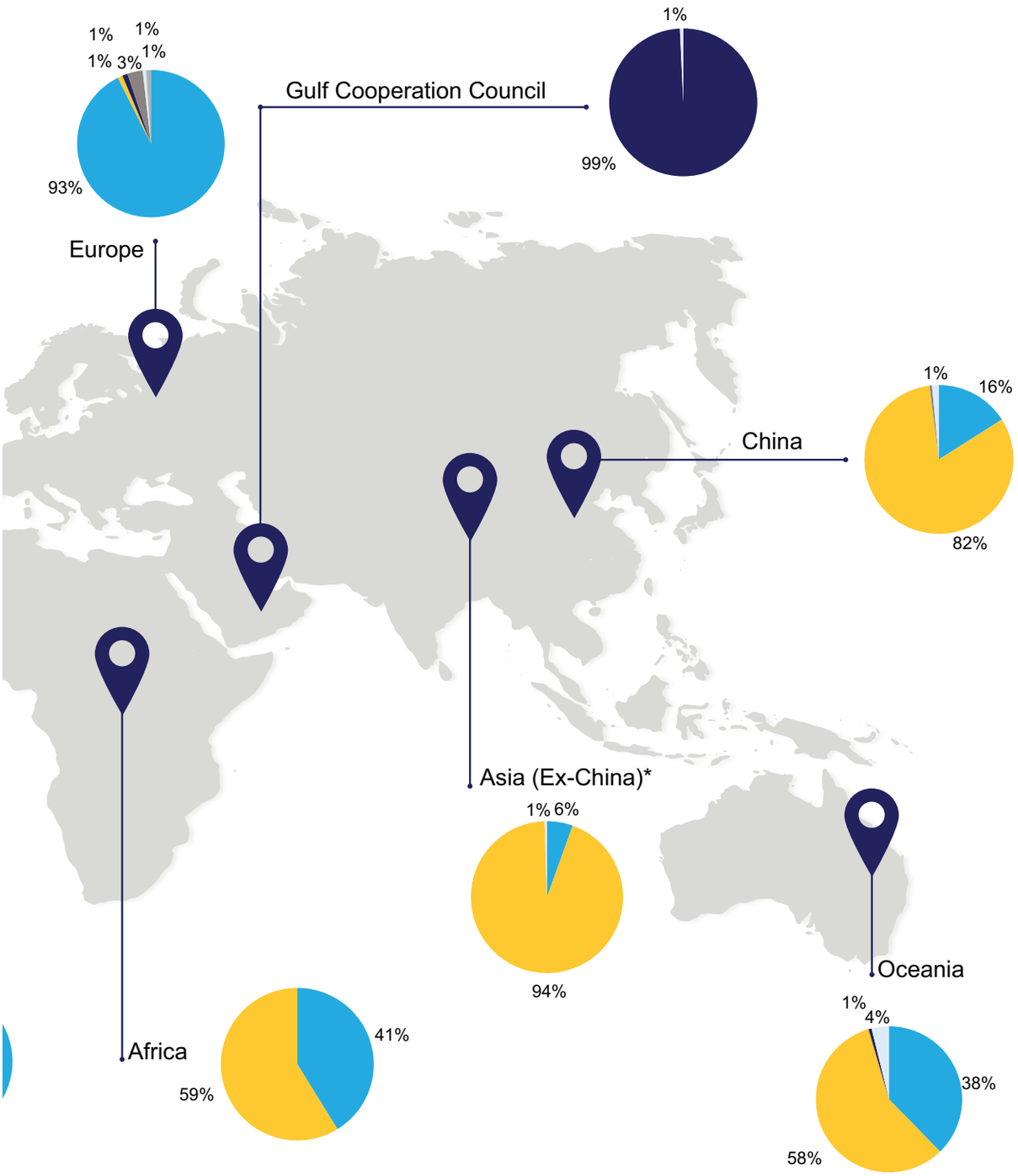
MEASURING UP CARBON FOOTPRINT

Exhibit 24

Entities from developed nations better placed in terms of power sources than India and China



India's and China's reliance on coal-powered electricity and energy-intensive production processes amplifies their indirect emissions footprint, potentially leading to even higher compliance costs and reduced competitiveness in the EU market. Consequently, these countries would need to accelerate their transition to renewable energy and improve energy efficiency in their production processes to mitigate the increased exposure.

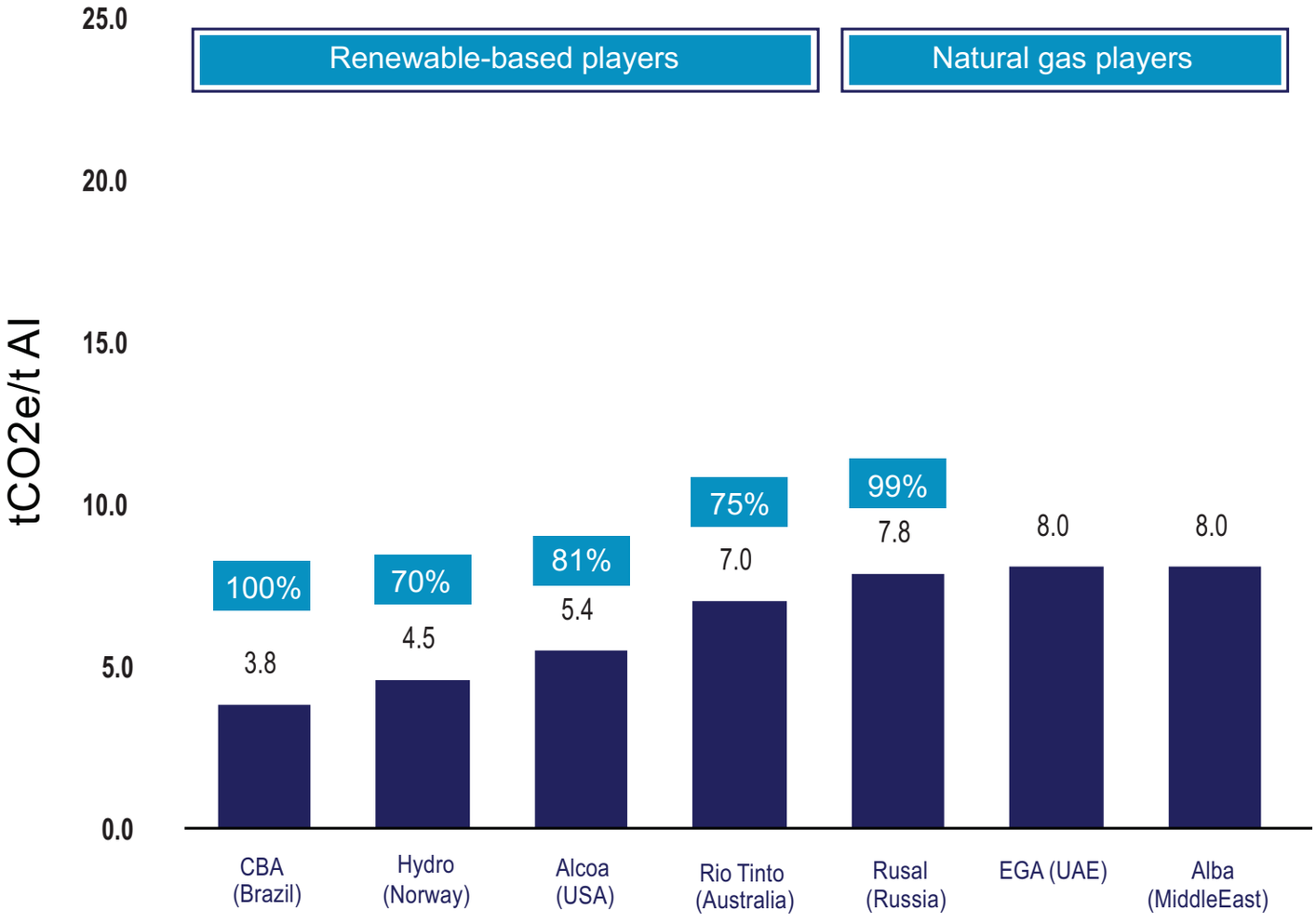


Source: *International Aluminium Institute, ICRA Research; SG: Self-generated, P: Purchased from supplier;*
**India is covered in Asia (ex-China)*

Several entities in developed nations have switched to lower carbon power (renewable) sources with almost 60% lower carbon emission intensity

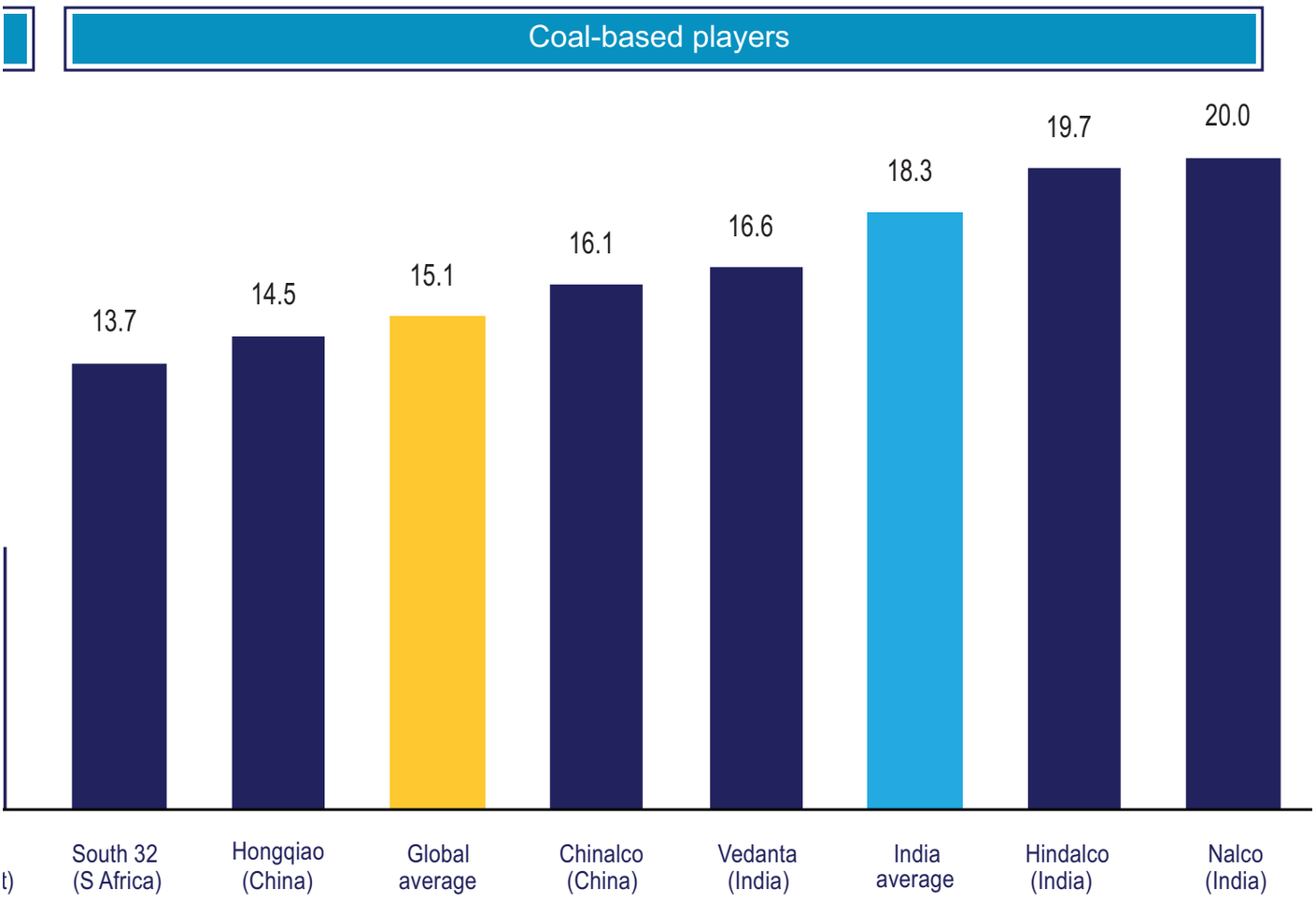
Exhibit 25

Comparison of GHG intensity (scopes 1+2) of major aluminium producers (globally)



Source: *Public disclosures of entities, ICRA Research; % denotes renewable share in total energy consumption*

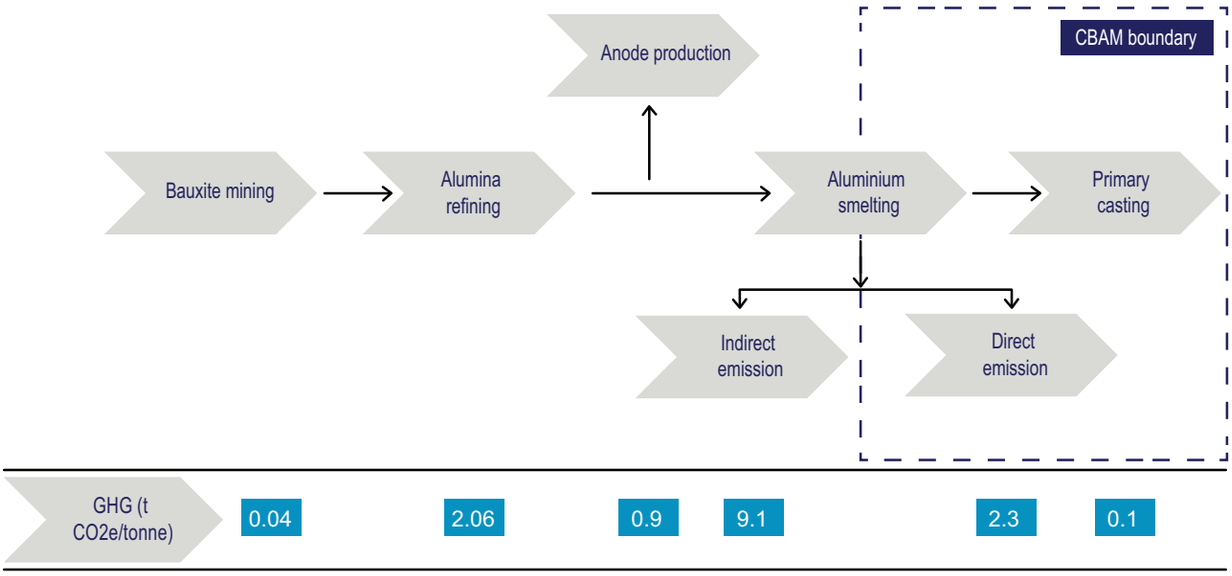
The carbon intensity of the top 13 primary aluminium producers (contributing ~40% to total global production) reflects that companies operating mostly in developed nations have already shifted to lower carbon power such as hydropower and solar, resulting in almost 50-60% lower emission intensity than those operating in developing nations. India's average carbon intensity is around 18 tCO2e/tonne of aluminium, owing to usage of coal linkage and captive coal mines. Global average is 15.1 tCO2e/tonne, which makes the average GHG intensity of the top three domestic primary aluminium producers higher by an even steeper 21%.



While the carbon intensity of the domestic primary aluminium producers is significantly higher than the global counterparts, the CBAM impact on domestic entities would be limited as the CBAM boundary at present is restricted to direct emission in smelting and casting and the share of direct emission in total emissions is very limited. Also, the inclusion of indirect emission is unlikely to happen in CBAM until the electricity grid in the EU is entirely decarbonised.

Exhibit 26

CBAM boundary

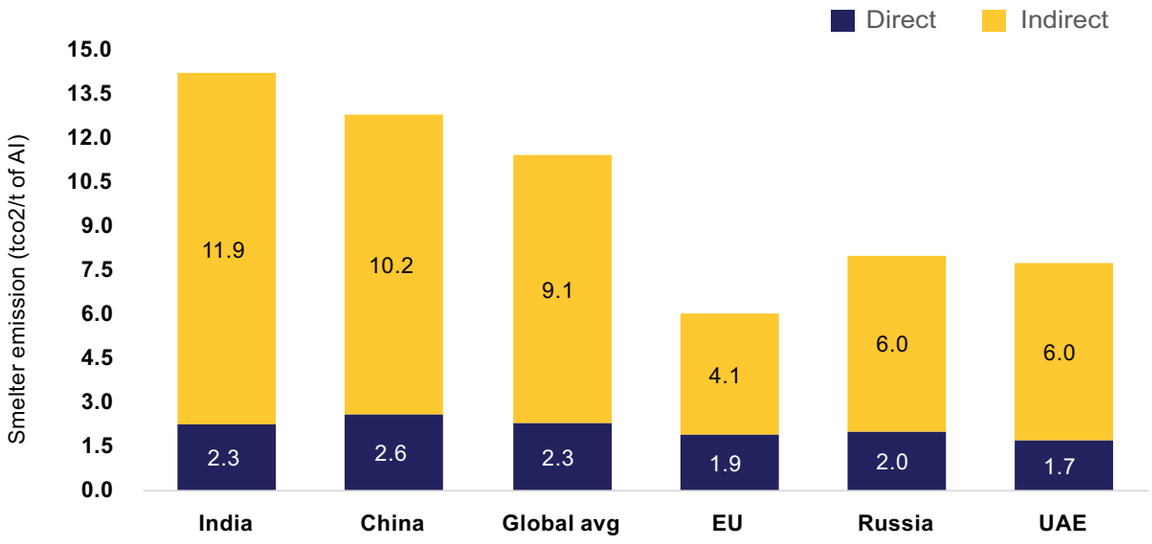


Source: *International Aluminum Institute, ICRA Research*

The raw materials, i.e., bauxite, alumina and anode production are outside the CBAM scope. In addition, the indirect emission (~9.1 tCO2e/tonne AI) generated during the smelting process will not be considered under CBAM. Consequently, the CBAM boundary is restricted to only direct emission generated during the smelting and casting processes, which constitutes only ~15-16% of the total carbon emission in the entire value chain of the aluminium production.

Exhibit 27

Smelter related emission in key countries (tCO2/t of AI)

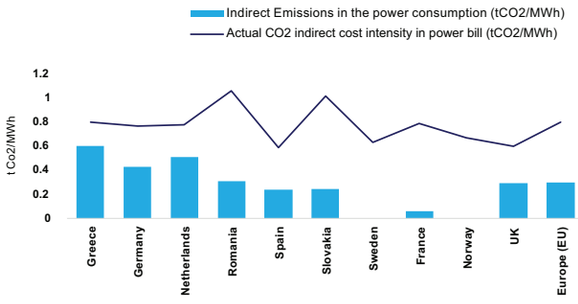


Source: *Public disclosures of entities, ICRA Research; *only smelter related emissions*

Consequently, inclusion of only direct emission of smelters will have limited impact on the domestic industry from January 2026. Also, direct emission from smelter of domestic primary aluminium entities is not significantly different from other competing suppliers to the EU. The major difference lies in the indirect emission, wherein low carbon power sources of other countries result in much lower emission than Indian and Chinese smelters. So, India is unlikely to be an outlier on direct emissions and the trade flows to Europe is unlikely to be materially impacted. If the EU expands CBAM to include indirect emissions, the ramifications for India and China could be substantial due to their significantly higher indirect emissions intensities — approximately three times or more than those of Europe.

Exhibit 28

European electricity emission intensity and indirect cost embedded in the power price



Source: *European Aluminium, ICRA Research*

Exhibit 29

Indirect cost comparison of a European smelter vs. CBAM levy on other importing countries

Particulars	Norway	Russia	India
Power source	Hydro	Grid	CPP
Electricity intensity (tonne CO2 per MWh)*	0.0	0.4	0.8
Indirect emissions of CO2 per tonne aluminium**	0.0	5.7	12.2
Indirect cost intensity per MWh of electricity (applicable only for Europe)^	0.7	-	-
Scope 2 cost (€/tonne) assuming EUA = 60€/tonne	603	342	729

Source: *European Aluminium, ICRA Research; *as per grid intensity data; **assuming power consumption of 15 MWh/tonne; ^owing to marginal pricing system followed in EU's wholesale electricity market*

However, the indirect emissions are unlikely to be included in the near term as it will severely impact the European entities' competitiveness. In the EU, while the indirect emission from aluminium production is significantly lower than the global average, the aluminium industry still pays for the indirect cost of carbon emissions in the electricity system through the power price as the power plant that sets the electricity price in the EU's marginal pricing system is often a natural gas or coal-fired power plant. These indirect costs are compensated through subsidies to avoid carbon leakage.

However, CBAM on indirect emission will replace the indirect cost compensation, which will severely dent the EU's competitiveness as the indirect cost (as shown in Exhibit 29 above for Norway) will be higher than CBAM levy on indirect emission of importing countries like Russia. Consequently, until the EU's electricity grid is entirely decarbonised, indirect emission is unlikely to be included in CBAM. Indian entities, however, owing to coal-fired power plants, would have higher CBAM's levy than the indirect cost of most European countries. Consequently, impact on domestic entities would be severe if the indirect emission is included under CBAM regulations.

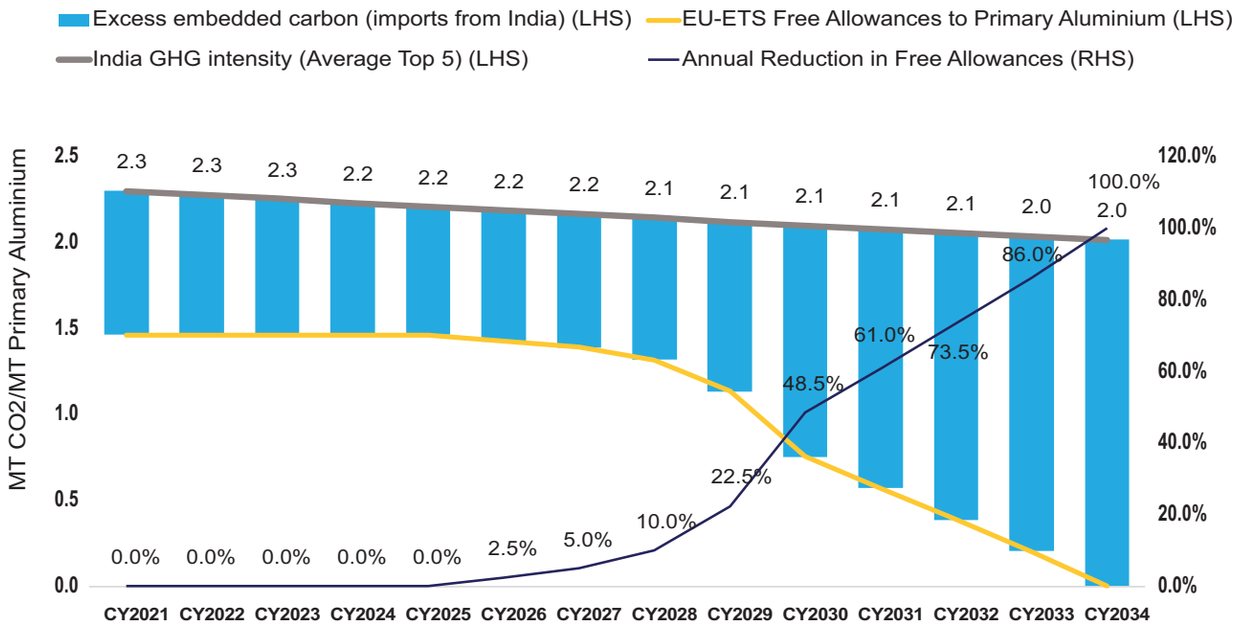
COUNTING THE COSTS

After the end of the transition period ending December 31, 2025, the phasing-out of free allocation under the EU-ETS will take place parallelly with the phasing-in of CBAM over the subsequent eight years (CY2026-CY2034). The current EU-ETS free allocations benchmark for the primary aluminium stands at ~1.46 MT CO2/MT aluminium (only scope 1 emissions).

The domestic primary aluminium producers have an average direct emission intensity of ~2.3 MT CO2/ MT aluminium, which is in line with the global average but ~30% higher than the benchmark EU-ETS free allocations at present. With the gradual phasing out of the free allocation, the excess embedded emission is expected to peak in CY2034.

Exhibit 30

Trend in EU-ETS free allowance for EU primary aluminium player vs. average GHG emission intensity (scope 1) of leading Indian, primary aluminium player

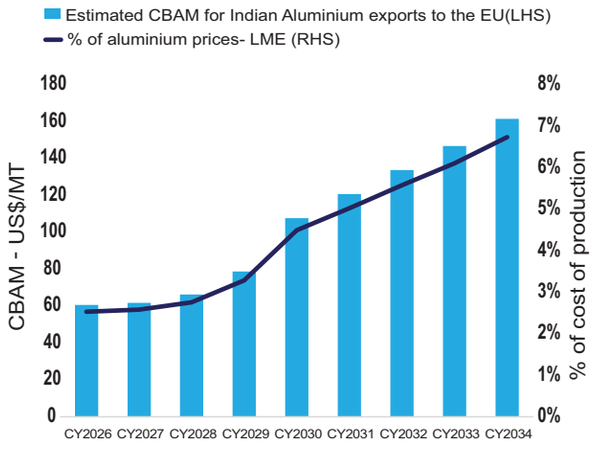


Source: *European Commission, ICRA Research; trajectory of reduction in GHG intensity for Indian players estimated*

ICRA's analysis suggests minimum impact of $60-160/MT (~3-7% of aluminium prices) during CY2026–CY2034, as indirect emission is not considered in CBAM. However, in case the indirect emission is also included in future, the impact would be significant at ~$750-800/MT (~30-33% of the current aluminium prices).

Exhibit 31

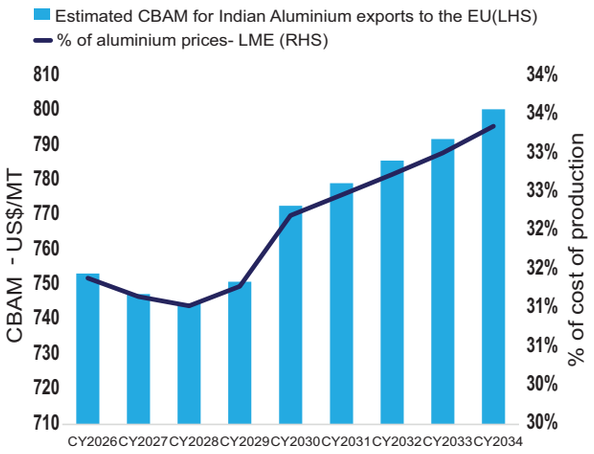
Potential CBAM for Indian aluminium exports to the EU (only direct emission)



Source: *ICRA Research; price of carbon assumed constant at €74/MT ($80/MT)*

Exhibit 32

Potential CBAM for Indian aluminium exports to the EU (direct + indirect emissions)



Source: *ICRA Research; price of carbon assumed constant at €74/MT ($80/MT)*

Fertiliser Sector Impact Analysis

The fertiliser industry plays a critical role in global agriculture by enhancing crop yields and food production. The industry primarily produces nitrogen-based fertilisers (such as urea and ammonium nitrate), phosphate fertilisers, and potash fertilisers. Nitrogen fertilisers, in particular, are energy-intensive to produce and are associated with substantial GHG emissions, mainly in the form of carbon dioxide (CO2) and nitrous oxide (N2O).

Fertiliser production involves processes like ammonia synthesis, which typically relies on natural gas as a feedstock and energy source. This reliance on fossil fuel makes the fertiliser industry one of the more carbon-intensive sectors in manufacturing. The EU has stringent emission reduction targets, and the inclusion of fertilisers under CBAM underscores the EU's commitment to reducing the carbon footprint of all sectors, including agriculture.

For EU-based fertiliser producers, CBAM could provide a competitive advantage by levelling the playing field. These producers already incur costs associated with carbon emissions under the EU-ETS. By extending similar costs to imports, CBAM aims to prevent carbon leakage—the relocation of production to countries with laxer emission norms—and support domestic industries in their transition to greener technologies. This could lead to increased investment in cleaner production methods within the EU, fostering innovation and efficiency in the fertiliser industry.

An increase in fertiliser costs due to CBAM could have a downstream effect on agricultural costs and food prices. Farmers, particularly in the EU, might face higher input costs, which could translate into increased food prices for consumers. The extent of this impact will depend on various factors, including the ability of farmers to pass on costs, the availability of alternative fertilisers, and potential subsidies or support measures from governments to mitigate the impact on the agricultural sector.

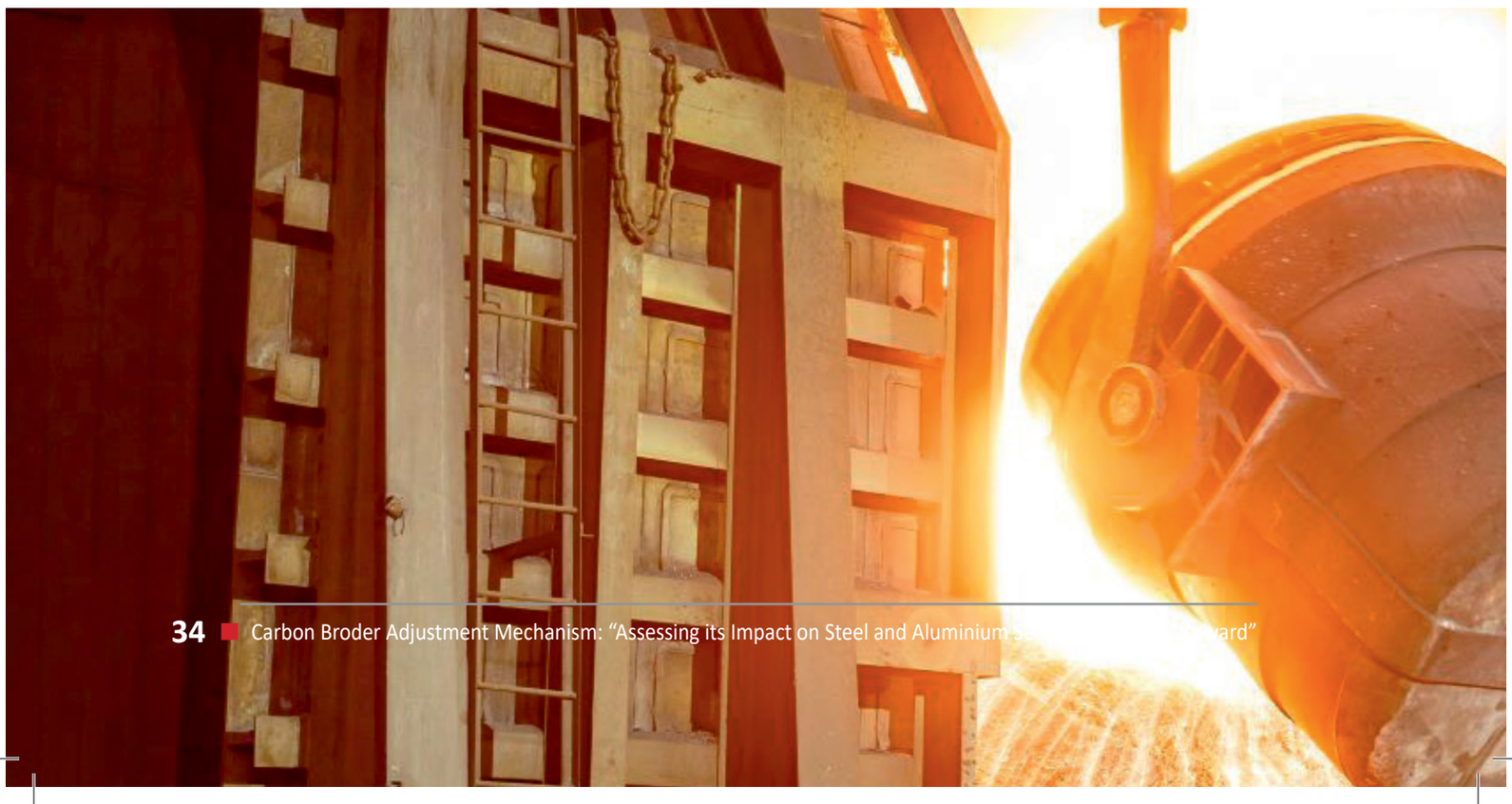
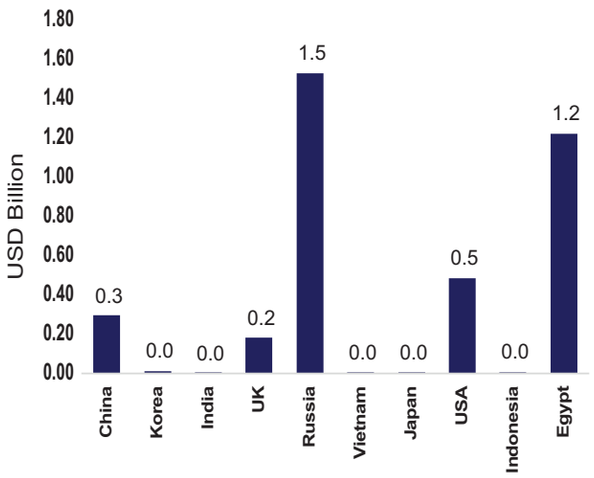


Exhibit 33

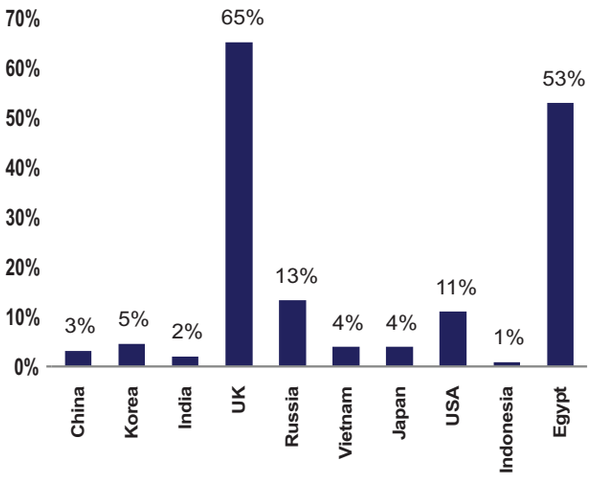
Country-wise export to the EU (in CY2023)



Source: *World Bank data, ICRA Research*

Exhibit 34

EU's fertiliser export as % of total fertiliser export



Source: *World Bank data, ICRA Research*

Applying the EU-ETS carbon price to the carbon content of Indian fertilisers, the additional cost imposed by CBAM on Indian fertiliser exports to the EU could be significant. For instance, for a shipment of 100,000 metric tonnes of nitrogen fertiliser, the additional cost due to CBAM could range from €21.25 million to €25.5 million. This substantial cost increase could affect the pricing and competitiveness of Indian fertilisers in the EU market. Nonetheless, the EU imports of fertilisers from India stood at $2 million for 2023. Thus, its impact on Indian fertilisers industry is not likely to be material.

Cement Industry and CBAM: Impact and Adaptation

The CBAM ruling on exports to the EU will have negligible impact on the domestic cement producers, due to the sector's domestic focus and ongoing sustainability efforts. This relative insulation from CBAM enables Indian cement producers to maintain their competitive edge while continuing to drive growth in domestic and regional markets. The products covered under CBAM regulations include calcined clay, cement clinker, cement and aluminous cement. The cement sector has to account for both direct emissions and indirect emissions, in the transitional period as well as during the definitive period.

India is not a major exporter of cement to the EU. Most of India's cement production caters to domestic consumption, driven by the country's booming construction and infrastructure sectors. According to the Cement Manufacturers' Association, India's cement exports account for a small fraction of its total production, with primary export markets being neighbouring countries in South Asia and West Asia rather than Europe. Therefore, the direct exposure of Indian cement exports to the EU market is minimal.

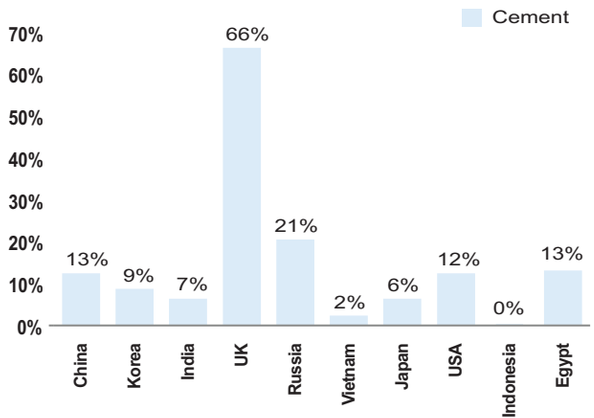
Exhibit 35

Country-wise export to the EU (in CY2023)

Source: *World Bank data, ICRA Research*

Exhibit 36

EU's cement export as % of total cement export

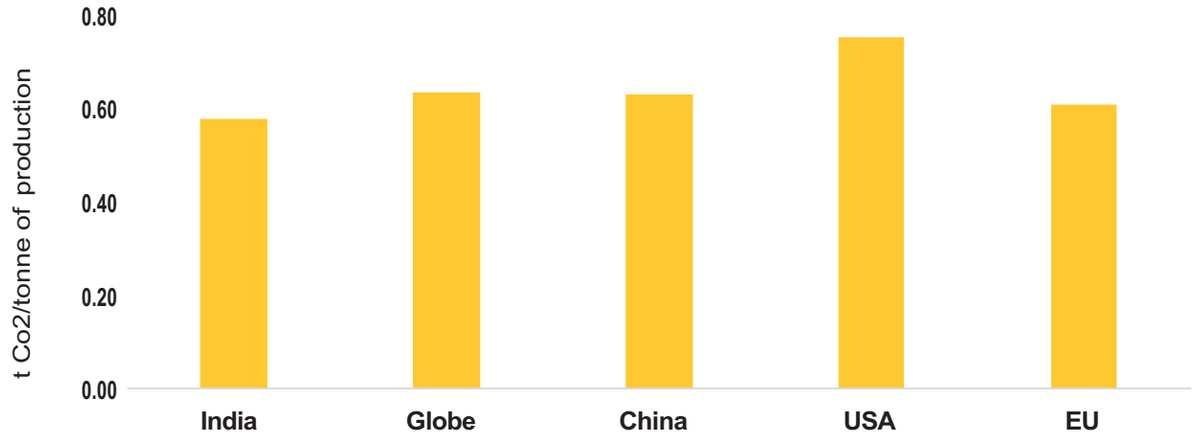


Source: *World Bank data, ICRA Research*

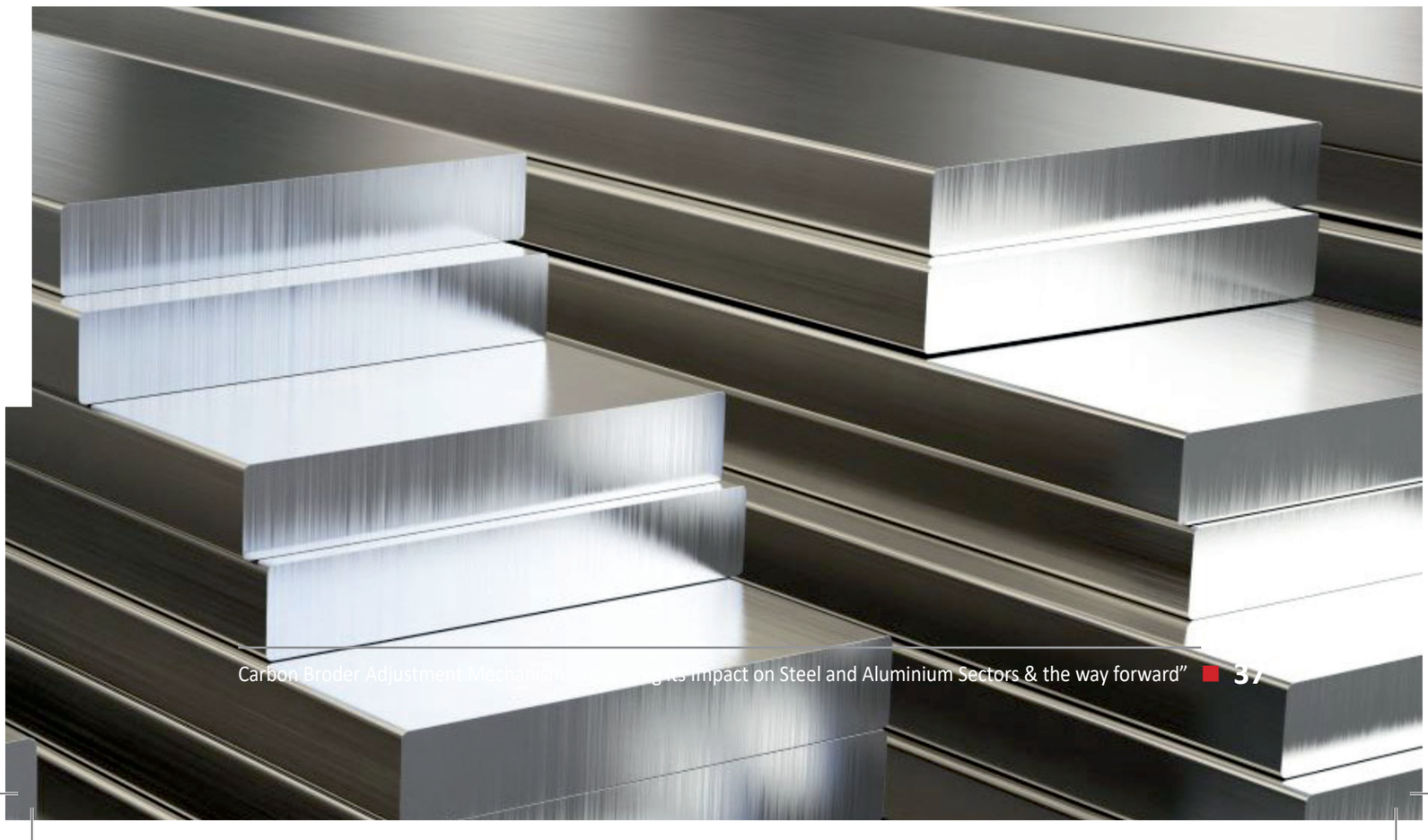
Secondly, the Indian cement industry has been progressively adopting energy-efficient technologies and alternative fuels, which help in reducing overall carbon emissions. These initiatives align with global sustainability trends and could partially mitigate the financial impact of CBAM if they were to export to the EU. Consequently, the carbon emissions are in line with the EU, resulting in minimal impact of the regulations.

Exhibit 37

Cement carbon emission intensity in key countries (tCO2/t of AI)



Source: *Compilation of data for countries, ICRA Research*



The Ascent of Carbon Prices

The European Union Allowance (EUA) is a key component of the EU-ETS, which is the primary tool used by the EU to reduce GHG emissions. Each EUA permits the holder to emit one tonne of carbon dioxide equivalent (CO_2e). These allowances are either allocated for free or auctioned by the governments of the EU member states, and they can be traded on the secondary market. The price of EUAs fluctuates based on supply and demand dynamics within the EU-ETS.

Since 2021, the spot carbon prices in the EU-ETS have seen a significant ascent, driven by a combination of regulatory reforms, increased climate ambition, and market dynamics. The EU's enhanced climate targets, including the European Green Deal aiming for carbon neutrality by 2050, have intensified market expectations for future scarcity of allowances, propelling prices upward. As reiterated in the UN Climate Change conference (COP28), for achieving net-zero by 2050, the 27-member EU has also fixed 2050 as the net-zero transition date. Within the EU, Germany stands out, as it has fixed a stricter deadline of 2045.

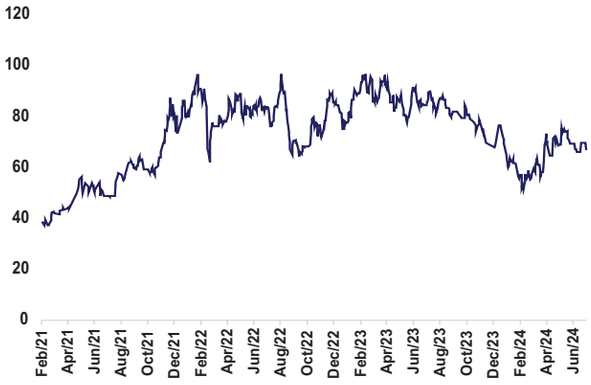
Exhibit 38

Country-wise export to the EU (in CY2023)

Source: *ICRA Research*

Exhibit 39

Spot Carbon Dioxide (CO2) Emissions EU Allowance Price/Europe



Source: *Bloomberg, ICRA Research*

Given these net-zero commitments by European markets, carbon price in the EU-ETS more than doubled since the beginning of CY2021. Meanwhile, above carbon prices have declined in FY2024 owing to weak industry demand amid macroeconomic uncertainties.

However, given these net-zero commitments by European countries, carbon prices in the EU-ETS are expected to increase in the medium term.

The Green Mile: Strategies to Reduce Carbon Footprint

Reducing carbon emissions is a crucial prerequisite for domestic entities, driven by multiple compelling factors. Firstly, the global shift towards sustainable practices is gaining momentum, with stringent environmental regulations being implemented worldwide. Secondly, investors are increasingly prioritising environmental, social, and governance (ESG) criteria in their investment decisions.

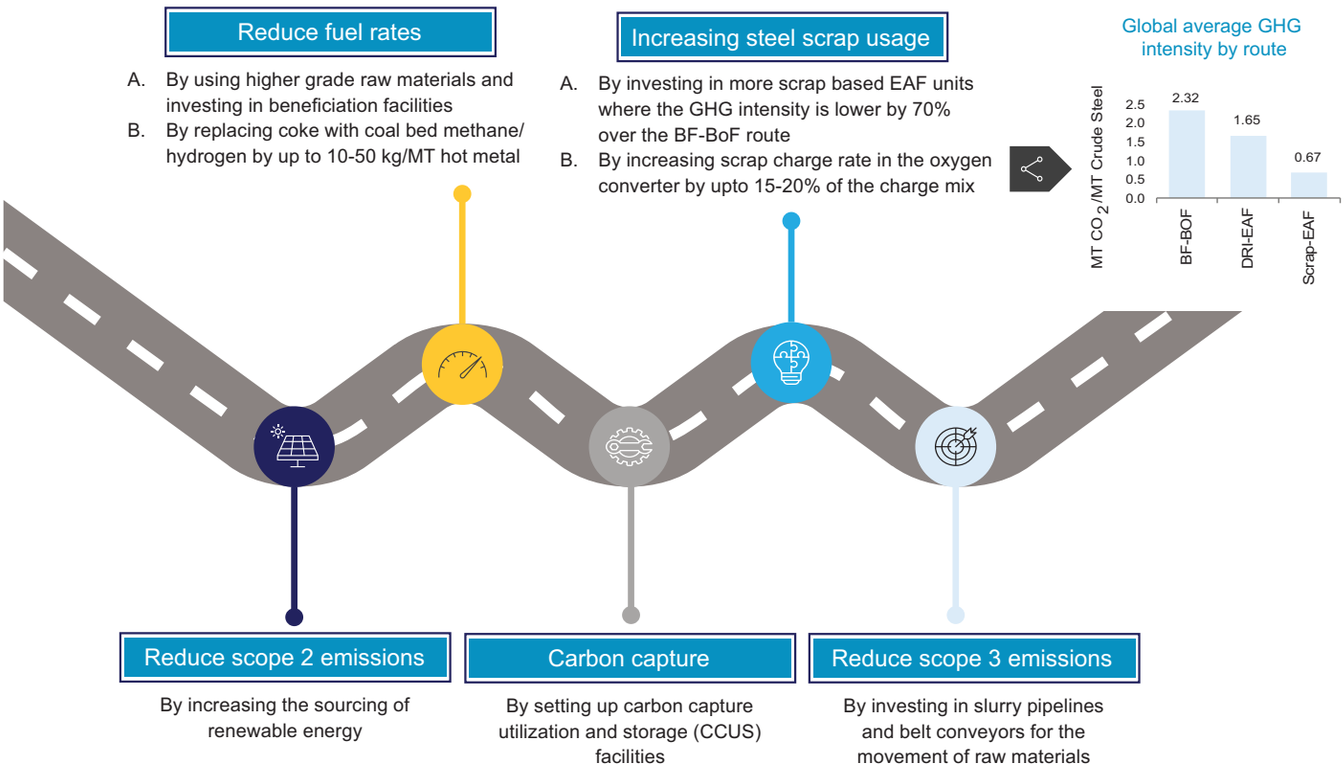
Additionally, reducing carbon emissions enhances operational efficiency and lowers energy costs, contributing to improved profitability in the long term. Lastly, by adopting sustainable practices, these companies can contribute to national climate goals while securing their future viability in an increasingly carbon-conscious global market.

Some leading domestic steel mills targeting to reduce GHG intensity by 25-30% to 1.8-1.95 MT CO2/MT crude steel in CY2030

Following India's 2070 net-zero target, over the next decade, domestic steelmakers have sharpen their focus on reducing their carbon footprint by as much as 25-30% through various technological interventions. Notable emission-reduction pathways include increasing the share of renewables and scrap in the steelmaking process, using superior-grade raw materials or alternative fuels like hydrogen/ coal bed methane for decreasing fuel rate in furnaces, investments in logistics infrastructure like slurry pipelines/belt conveyors for reducing indirect emissions associated with raw material movement and setting up carbon capture utilisation and storage units. However, this transition towards emerging low-carbon technologies could entail significant capital investments for steel manufacturers.

Exhibit 40

Pathways being adopted by domestic steelmakers to reduce GHG footprint



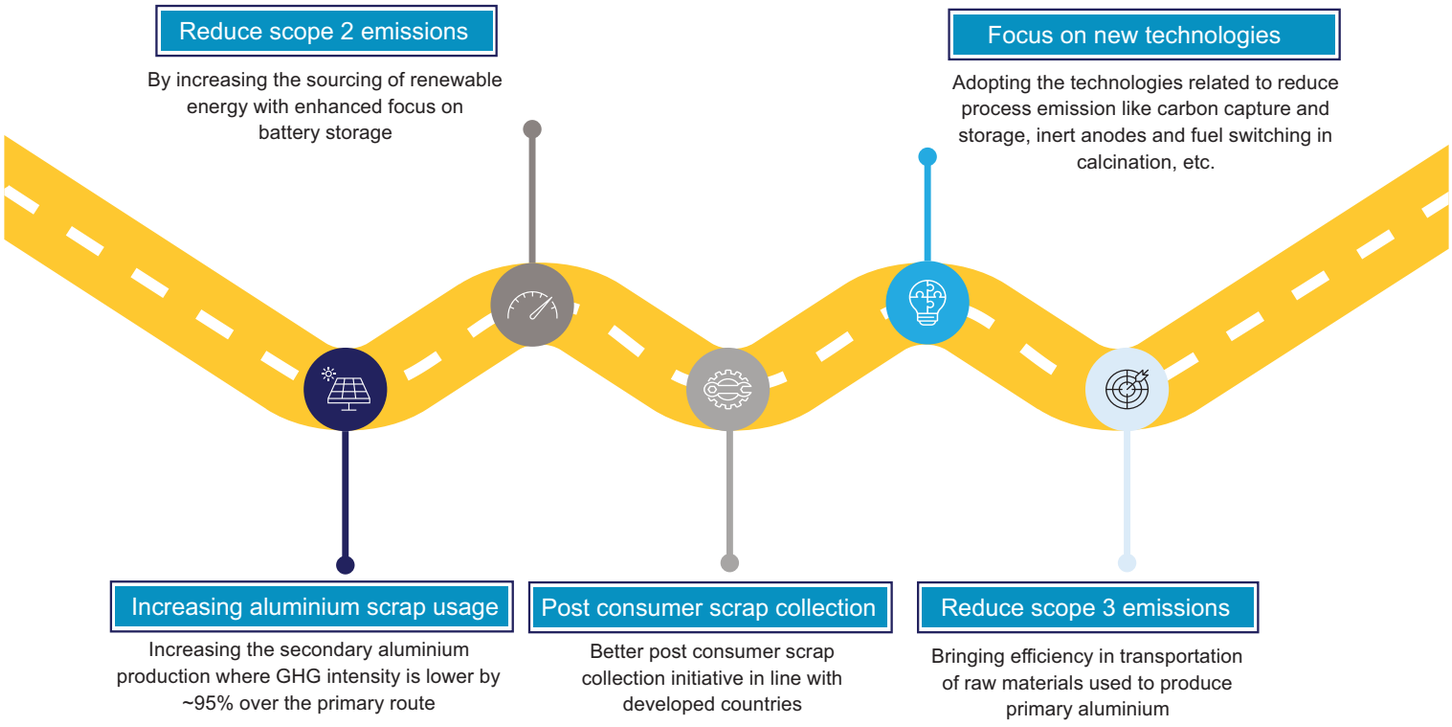
Source: *World Steel Association, ICRA Research; Scope 3 emissions include all sources not within an organisation's scope 1 and 2 boundaries. This includes embedded emissions from the purchase of raw materials and inward/ outward logistics*

Domestic primary aluminium producers target reducing GHG intensity by 25% in next 5-7 years and achieve net-zero by 2050

The aluminium sector's transition to net-zero emissions is gaining traction with entities setting ambitious goals. While 25% emission reduction is projected by 2030, most entities, including domestic ones, have taken a long-term target to achieve net zero by 2050, in line with the International Aluminium Institute (IAI) target. Notable emission-reduction pathways include using significant renewable power and adopting technologies to reduce process emissions like carbon capture and storage, and inert anodes. However, this transition towards emerging low-carbon technologies, primarily shifting to Renewable Energy (RE) power, could entail significant capital investments. Nonetheless, instead of doing an upfront capex, entities may choose to sign power purchase agreements to secure RE power.

Exhibit 41

Pathways being adopted by domestic primary aluminium producers to reduce GHG footprint



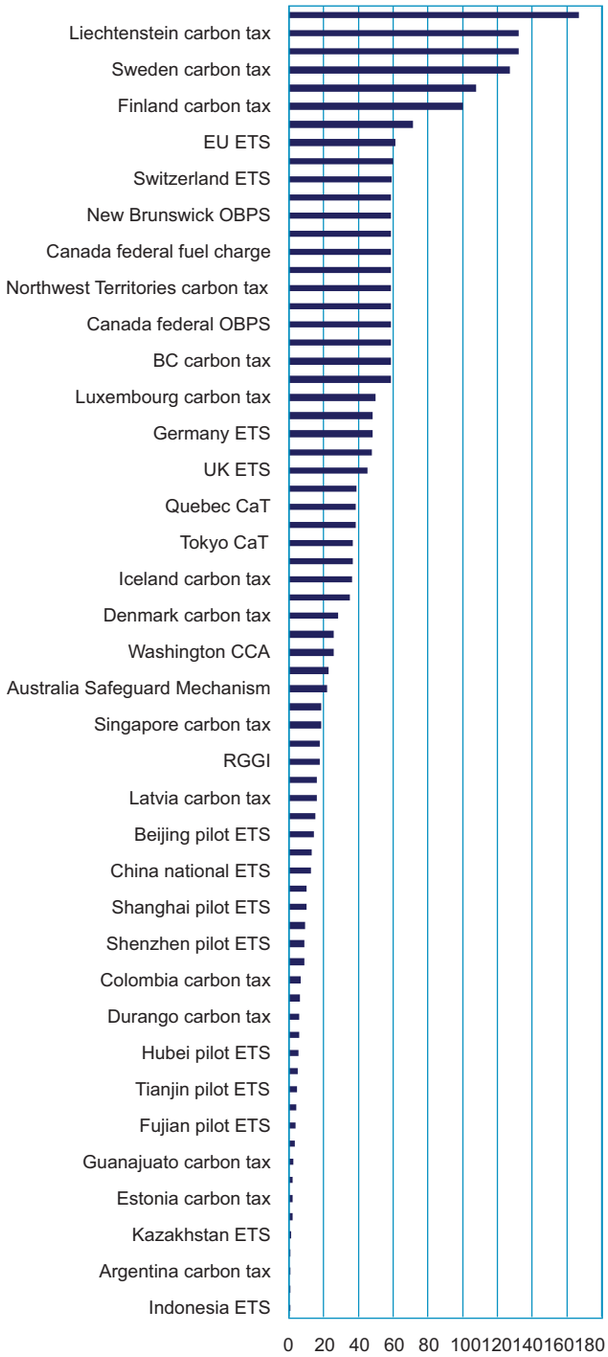
***Source**: ICRA Research; **Scope 3** emissions include all sources outside an organisation's scope 1 and 2 boundaries. This includes embedded emissions from the purchase of raw materials and inward/ outward logistics*

Conclusion

The analysis of the CBAM and its implications for Indian entities underscores significant challenges and necessitates strategic shifts to ensure compliance and maintain competitiveness in the EU market. CBAM aims to level the carbon cost disparity between EU and non-EU producers, particularly impacting industries with high GHG emissions such as steel and aluminium. However, if the scope of the CBAM is not expanded to include other sectors and to cover Scope 2 and Scope 3 carbon emissions, input costs for various sectors in the EU will significantly increase. For the Indian steel sector, which heavily relies on carbon-intensive production methods like the BF-BoF route, transitioning to greener technologies is critical. The average CO2 emission intensity for Indian steelmakers significantly exceeds global averages, highlighting the need for substantial investments in cleaner technologies, such as EAFs and carbon capture, utilisation, and storage (CCUS). The aluminium sector, while also facing high carbon intensity due to coalpowered electricity, may experience a limited immediate impact from CBAM since it currently focuses on direct emissions in smelting and casting. However, the future inclusion of indirect emissions could substantially increase compliance costs for Indian producers, necessitating a shift towards renewable energy sources to mitigate this risk. Additionally, the Indian Government could consider implementing a carbon tax on domestic entities to promote the use of green energy. Overall, the implementation of CBAM by the EU emphasises the urgency for Indian steel and aluminium producers to enhance their environmental performance through technological upgrades and increased use of renewable energy. Aligning with global sustainability standards is essential for maintaining competitiveness in the international market and mitigating the financial impact of CBAM. This comprehensive approach will ensure the longterm viability of India's industrial sectors in an increasingly carbon-conscious global economy.

Exhibit 42

Prices of carbon around the globe in 2024 (in $)



Source: *World Bank, ICRA Research; Prices are not directly comparable due to diferences in coverage, compliance and compensation arrangements.*

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About ICRA

ICRA Limited (formerly Investment Information and Credit Rating Agency of India Limited) was set up in 1991 by leading financial/investment institutions, commercial banks and financial services companies as an independent and professional investment Information and Credit Rating Agency. Today, ICRA and its subsidiaries together form the ICRA Group of Companies (Group ICRA). ICRA is a Public Limited Company, with its shares listed on the Bombay Stock Exchange and the National Stock Exchange.

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About ASSOCHAM

The Knowledge Architect of Corporate India

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states, and key cities globally, ASSOCHAM also has more than 400 associations, federations, and regional chambers in its fold.

Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward-looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

With more than 100 national and regional sector councils, ASSOCHAM is an impactful representative of the Indian industry. These Councils are led by well-known industry leaders, academicians, economists and independent professionals. The Chamber focuses on aligning critical needs and interests of the industry with the growth aspirations of the nation.

ASSOCHAM is driving four strategic priorities – Sustainability, Empowerment, Entrepreneurship and Digitisation. The Chamber believes that affirmative action in these areas would help drive an inclusive and sustainable socio-economic growth for the country.

ASSOCHAM is working hand in hand with the government, regulators, and national and international think tanks to contribute to the policy making process and share vital feedback on implementation of decisions of far-reaching consequences. In line with its focus on being future-ready, the Chamber is building a strong network of knowledge architects. Thus, ASSOCHAM is all set to redefine the dynamics of growth and development in the technology-driven 'Knowledge-Based Economy. The Chamber aims to empower stakeholders in the Indian economy by inculcating knowledge that will be the catalyst of growth in the dynamic global environment.

The Chamber also supports civil society through citizenship programmes, to drive inclusive development. ASSOCHAM's member network leads initiatives in various segments such as empowerment, healthcare, education and skilling, hygiene, affirmative action, road safety, livelihood, life skills, sustainability, to name a few.

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