The missing carbon signal: How CBAM's exclusion of scope 2 emissions undermines its climate/ trade objectives

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- Scope 2 (indirect) emissions, from the electricity used in production, account for approximately 80% of total emissions in primary aluminium yet remain unpriced under the Carbon Border Adjustment Mechanism (CBAM), weakening the mechanism's environmental effectiveness.
- The exclusion stems from the European Union Emissions Trading System (EU ETS) Indirect Cost Compensation (ICC) mechanism, which compensates producers for the electricity cost pass-through of carbon prices on the power sector. Eligible industries have been expanded to additional sectors, including iron and fertiliser, at the end of 2025. According to the EU Commission, indirect emissions should not be charged a CBAM fee for goods "in respect of which financial measures apply in the Union that compensate for indirect emissions costs".
- Without scope 2 pricing, CBAM fails to send a signal to reward clean electricity sourcing globally. An aluminium smelter on a coal-heavy grid will pay the same CBAM charge as one powered by hydroelectricity.
- Scope 2 pricing would improve the competitiveness of producers in countries endowed with renewable electricity. The Mozal aluminium smelter in Mozambique, powered by hydropower from the Cahora Bassa dam, would face CBAM costs of roughly EUR 140 /t versus EUR 800-1,100 /t for Indian, Chinese, or South African coal-dominated-grid competitors.
- The EU has committed to reviewing scope 2 inclusion for aluminium, iron and steel, and hydrogen with a report due in 2027. This brief provides the analytical and empirical basis for understanding the stakes of the review.

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Executive summary

The EU Carbon Border Adjustment Mechanism (CBAM) entered its definitive phase in January 2026, requiring EU importers of carbon-intensive goods to purchase certificates priced in line with EU Emissions Trading System (EU ETS) allowances. While CBAM represents a landmark advance in climate-aligned trade policy, it contains a significant gap: scope 2 (indirect) emissions, emissions arising from the electricity consumed during production, are excluded for the aluminium, iron and steel, and hydrogen sectors.

This brief examines why this exclusion exists and why addressing it is essential for CBAM's effectiveness in the aluminium sector. Aluminium is the central case study because scope 2 emissions typically account for the majority of its total embedded emissions—approximately 80% of global aluminium emissions according to the 2023 data from Wood Mackenzie.

The brief also explores another positive implication of scope 2 pricing: it would improve the competitive position of producers in developing countries that have invested in renewable electricity. The Mozal aluminium smelter in Mozambique, offers a compelling case study. Under current CBAM rules, Mozal's clean energy advantage is invisible at the EU border. Scope 2 pricing would change that by hundreds of euros per tonne.

Background: CBAM's scope and the scope 2 Exclusion

CBAM establishes a carbon price on certain imports by requiring authorised declarants to purchase CBAM certificates corresponding to the embedded greenhouse gas emissions of those imports. Certificate prices track average EU ETS allowance prices and are calculated quarterly in 2026 and weekly from 2027 onward. This is intended to level the playing field: domestic EU producers pay for their emissions through the EU ETS, and foreign importers face an equivalent cost at the border.

Embedded emissions are defined to include:

- Scope 1 (direct) emissions: those arising from on-site combustion, process chemistry (for example, calcination in cement), and other direct releases at the production installation.
- Scope 2 (indirect) emissions: those associated with the generation of electricity consumed during production. These are included for cement and fertilisers, but explicitly excluded for iron and steel, aluminium, and hydrogen under Annex II of Regulation (EU) 2023/956.

The distinction is especially important for aluminium. The predominant smelting process, the Hall-Héroult process, is electricity-intensive, consuming roughly 13,000-16,000 kWh/t of aluminium produced. The carbon intensity of the supplying grid is therefore the primary determinant of a smelter's lifecycle emission profile.

The statutory basis for the exclusion

The exclusion is codified in the regulation that establishes the EU CBAM (Annex II of Regulation (EU) 2023/956), which notes that indirect emissions "should not be taken into account initially for the goods in respect of which financial measures apply in the Union that compensate for indirect emissions costs incurred from greenhouse gas emission costs passed on in electricity prices." These financial measures are the EU ETS Indirect Cost Compensation mechanism.

The ICC is state aid that allows member states to compensate energy-intensive industries for higher electricity prices resulting from the EU ETS carbon price being passed through by power generators. Because EU producers of iron and steel, aluminium, and hydrogen may receive ICC payments, the European Commission designed CBAM to exclude scope 2 charges for these sectors, reasoning that applying both instruments simultaneously would create overlapping carbon leakage protection and create an unfair advantage for domestic producers over their foreign competitors.

Statutory language — Regulation (EU) 2023/956

"Indirect emissions should, however, not be taken into account initially for the goods in respect of which financial measures apply in the Union that compensate for indirect emissions costs incurred from greenhouse gas emission costs passed on in electricity prices."

The Indirect Cost Compensation mechanism

What ICC is designed to do

When the EU ETS prices carbon emissions in the power sector, electricity generators pass those allowance costs downstream through higher power prices. Aluminium smelters, as large power consumers, bear a substantial electricity cost burden due to this pass-through. Without any relief, these producers face a cost disadvantage relative to non-EU competitors operating in countries without carbon pricing. The ICC was designed to prevent this from driving energy-intensive industries such as aluminium out of the EU.

Under the ICC, EU member states may pay qualifying installations up to 75% of their indirect carbon costs, calculated based on electricity consumption, applicable regional CO_2 emission factors, and the EU ETS allowance price.

ICC and the EU CBAM

The European Commission currently treats Indirect Cost Compensation (ICC) as uniquely disqualifying from coverage of indirect emissions under CBAM, even though it is only one of many instruments that affect electricity prices paid by European industry. By the Commission's own accounting, as laid out by President von der Leyen in her 11 March 2026 address to the European Parliament, carbon costs make up roughly 11% of the average European electricity bill, with energy itself accounting for 56%, grid charges for 18%, and taxes and levies for 15%. At the same address, von der Leyen noted that electricity tax rates vary widely across Member States, with at least one Member State applying a 0% tax on retail electricity while others apply rates over 16%. Member States intervene actively across all of these components, with both taxes and subsidies, some that are environment-related (for example, surcharges on electricity bills which go to subsidising renewable generation, see Germany's Renewables Energy Act) and some that are not (for example, Greece, Italy, and Poland include charges on electricity bills to support public broadcasting). In general, interventions in electricity pricing have historically been a significant part of European industrial policy, and they are certainly not limited to ETS-linked policies.

Recent developments reflect these trends: On 16 April 2026, the Commission approved Germany's EUR 3.8 billion scheme for temporary electricity price relief for energy-intensive industries through 2028, and in response to the Iran conflict, von der Leyen signalled that the Commission is exploring subsidising or capping the price of natural gas in order to reduce wholesale electricity prices. In general, according to European Commission logic, these not-ETS-related interventions would not be grounds to restrict CBAM's coverage of indirect emissions, because the CBAM Regulation excludes indirect emissions only where financial measures specifically compensate for greenhouse gas emission costs passed on in electricity prices, that is, ICC.

Tying CBAM's scope to the EU's industrial policy can add unpredictability to the scheme, as illustrated by the current treatment of fertilisers. When CBAM legislation was published, cement and fertiliser producers could not claim ICC, with the reasoning that their electricity bills are not the primary pathway through which the EU ETS affects their costs. However, fertilisers became eligible ICC with the updated State Aid Guidelines published at the end of 2025. Currently, scope 2 emissions are still being priced for fertiliser imports under CBAM. In its December 2025 CBAM Q&A, the EU Commission said it would work to address

"overlaps between ICC and CBAM by an appropriate adjustment", but no implementing measure doing so has been published yet.

Meanwhile, the EU's major trading partners maintain their own subsidies for industrial electricity, and the Commission does not propose to narrow the scope of CBAM on that basis. Conditioning CBAM scope on ICC singles out a single policy lever, when in reality, many overlapping policies push industrial electricity prices up and down. In general, intervention in electricity prices is part of the industrial policy toolkit of governments. It is important that the scope and inherent predictability of the CBAM is not based on one particular policy out of the many that exist both in Europe and among Europe's trading partners.

The CBAM regulation acknowledges that it may review scope 2 inclusion for aluminium, iron and steel, and hydrogen in "future revisions of the EU ETS" and "revisions of the compensation measures." The Commission launched a call for evidence in August 2025, specifically addressing the expansion of embedded emissions coverage, and will release a report in 2027 on the CBAM scope extension to additional goods. The UK CBAM, launching in 2027, has similarly signalled it will not include indirect emissions until at least 2029.

The outsized role of scope 2 emissions in aluminium production

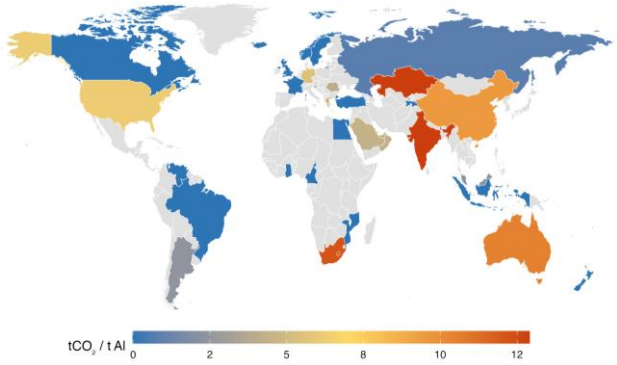
The electrolysis process

Primary aluminium is produced via the Hall-Héroult process, in which aluminium oxide is dissolved in a molten cryolite bath and reduced by electrolytic current to metallic aluminium. The process is electrochemical, and no viable commercial alternative exists at scale. By contrast, emissions in other CBAM sectors are distributed across direct and indirect pathways: steel production emissions are more evenly split between scope 1 (blast furnace coke combustion) and scope 2 (electric arc furnace electricity), and cement's profile is dominated by scope 1 process emissions from limestone calcination. Aluminium is therefore uniquely electricity-dependent, which is why the scope 2 exclusion has larger consequences for aluminium than for any other CBAM sector.

Global distribution of scope 2 emissions in aluminium

Average scope 2 emissions intensities vary widely by producing region. They are relatively higher in China, Kazakhstan, India, Australia, and South Africa, and lower in countries such as Brazil, Indonesia, Egypt, France, and Mozambique.

Figure 1: Average scope 2 emission intensities of aluminium-producing countries



Source: Wood Mackenzie Aluminum Smelter Report, 2023

Implications for CBAM signal

The competitive advantage of clean-electricity producers is not reflected in EU border costs. Since scope 2 emissions account for approximately 80% of total embedded emissions for the average non-EU aluminium import, the current CBAM charges only a small fraction of the true embedded carbon cost. For Chinese coal grid-based aluminium, average CBAM costs under scope 1 are roughly six times lower than under full scope 1 and 2 accounting.

Why scope 2 pricing is critical for CBAM's climate and trade objectives

Carbon leakage prevention

CBAM's core objective is to prevent carbon leakage. Carbon leakage occurs when EU climate policy raises domestic production costs, incentivising relocation to countries without equivalent carbon pricing and reimportation of embedded emissions at lower cost. Without scope 2 coverage for aluminium, a leakage pathway remains open. A non-EU producer on a coal grid can export aluminium to the EU and pay CBAM charges only on scope 1 emissions, while its large scope 2 cost bears no border charge.

Incentivising clean electricity investment globally

With the right policy design, CBAM can drive global investments in clean electricity. If the European Commission includes scope 2 emissions for aluminium, smelters with access to clean electricity will face materially lower CBAM costs than coal-grid competitors, creating financial benefits for companies that create renewable electricity power purchase agreements (PPAs) or locate new capacity near renewable resources. Under current scope-1-only rules, this signal does not exist at the EU border.

The global implications are significant. Countries endowed with renewable electricity, including Mozambique, Zambia, and Brazil, could see new

comparative advantages in aluminium and other electricity-intensive manufacturing emerge once the electricity source is properly priced at the border (Clausing et al., 2025). Moreover, countries that lack renewable electricity infrastructure, such as China, Australia, and South Africa, will be incentivised to invest in cleaner grids to remain competitive.

Case study: Mozal Aluminium (Mozambique) and the scope 2 competitiveness premium

Mozal is one of sub-Saharan Africa's largest industrial facilities and Mozambique's only primary aluminium smelter. Located near Maputo, it is majority-owned by South32, with minority stakes held by the Industrial Development Corporation of South Africa and the Government of Mozambique. The smelter has an annual production capacity of approximately 560,000 t.

Mozal's defining characteristic from an emissions perspective is its electricity source: most of its power comes from the Cahora Bassa hydroelectric dam complex on the Zambezi River, one of the largest hydroelectric facilities in Africa. This gives Mozal one of the lowest scope 2 emission intensities of any primary aluminium smelter in the world.

Mozal's revenues are also tied to European markets. According to the World Bureau of Metal Statistics (WBMS), over the past 12 months, since March 2025, Mozal has exported over 99% of its aluminium production to the EU.

Competitive implications under scope 1 versus scope 1+2

Under the current CBAM scope-1-only regime, Mozal pays nearly identical CBAM charges to other smelters on dirty coal- or gas-heavy grids, because scope 1 emissions are comparable across all producers. Under scopes 1 and 2, the price difference could reach EUR 900 /t at a EUR 70 /tCO_2e carbon price.

Table 1: CBAM certificate cost comparison: Mozal versus competitors

Region	2023 Production (Mt)	Scope 1 Emissions Intensity (t CO2/ t Al)	Scope 2 Emissions Intensity (t CO2 / t Al)	Total Emissions Intensity (t CO2 / t Al)	Scope 2 Share of Total Emissions	CBAM Fee on Scope 1 (at €70/t CO2)	CBAM Fee Scope 2 (at €70/t CO2)	CBAM Fee Scope 1 and 2 (at €70/t CO2)
India	4.1	2.0	12.9	14.9	87%	140	902	1042
China	41.7	2.1	9.6	11.6	82%	146	669	815
Middle East	6.1	2.0	4.4	6.4	69%	139	311	449
Europe	1.8	2.1	1.2	3.3	37%	148	85	233
Canada	3.3	1.9	0.0	1.9	0%	131	0	131
Norway	1.3	2.0	0.0	2.0	0%	139	0	139
Russia	4.0	2.7	0.8	3.5	23%	187	55	242
South Africa	0.7	1.9	12.1	14.0	87%	131	850	981
Mozambique	0.5	2.0	0.0	2.0	0%	143	0	143
Global	**69.4**	**2.1**	**7.5**	**9.6**	**78%**	**146**	**524**	**670**

Source: Wood Mackenzie Aluminum Smelter Report (Proprietary), 2023

The following figures show the capacity of global aluminium smelters, ranked by their emissions-intensity profiles. In each figure, Mozal's percentile of global capacity as a function of emissions intensity is labelled. While Mozal is

approximately average in terms of scope 1 intensity, it's cleaner than 88% of global capacity when scope 1 and scope 2 emissions are considered. As shown in Table 1, this would translate to a competitive advantage in European aluminium markets if CBAM priced scope 2 emissions.

Figure 2: Global aluminium capacity ranked by emissions intensity (scope 1 versus scope 1 and scope 2)

Figure 2a. Scope 1 emissions intensities

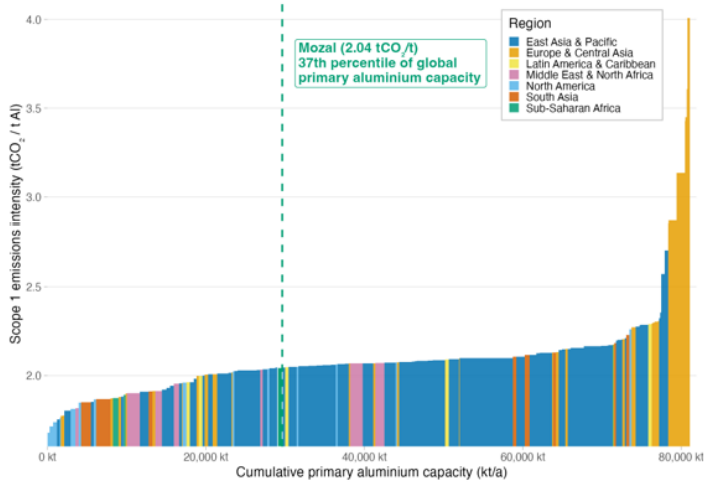
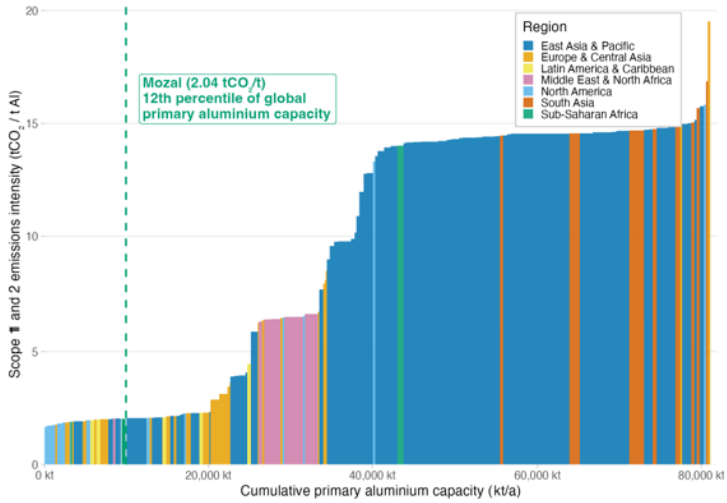


Figure 2b. Scope 1 and scope 2 emissions intensities



CBAM has been criticised for imposing compliance costs on developing countries with limited institutional capacity. However, Mozal's case illustrates a new dimension: for producers in developing countries with clean energy, including scope 2 emissions could create a competitive advantage for their exports to the EU.

Policy considerations

Use the review process established in the EU CBAM regulation to expand to scope 2

The European Commission will release a review report in 2027 that will consider expanding the scope of 2 emissions coverage under CBAM to include

the aluminium sector. Detailed public inputs, expert consultations, and research submitted during the review process would inform feasible expansion pathways.

Phase out ICC in coordination with CBAM phase-in

As CBAM certificates ramp toward 100% of embedded emissions by 2034, the rationale for ICC payments diminishes symmetrically. A published roadmap for ICC phase-out, coordinated with the CBAM free-allocation schedule, would create policy predictability and assuage the WTO-compatibility concern that currently blocks scope 2 inclusion.

Support scope 2 reporting and verification processes focused on clean electricity

EU technical assistance for CBAM compliance can support emissions reporting and verification abroad, including support for producers in countries with clean electricity. This is especially important to help developing countries demonstrate their scope 2 advantage, where local reporting capacity is often limited.

Conclusion

The exclusion of scope 2 emissions from CBAM coverage for aluminium is a policy choice meant to align CBAM with the EU ETS and its ICC compensation framework. But that choice carries real costs: it significantly reduces CBAM's environmental effectiveness in the aluminium sector, prices only a fraction of true embedded carbon, eliminates a major incentive for global clean electricity investment, and disadvantages low-carbon producers.

The case of Mozal illustrates these costs. A smelter with among the lowest carbon intensities in the world, powered by hydroelectricity, receives no competitive benefit for its clean electricity at the EU border under current rules. Scope 2 pricing could change that by hundreds of euros per tonne.

The EU has committed to revisiting this design choice. If the EU is intent on supporting global decarbonisation and wants CBAM to accurately reflect embedded carbon emissions, it will need to address the ICC-CBAM interaction in its 2027 review. Credible ICC phase-down pathways and strong support for reporting and verification abroad will be important considerations as the EU develops its report.

Without action, CBAM will continue to underprice imports from the aluminium sector, one of the world's largest sources of emissions, and leave its climate and trade objectives only partially fulfilled.

References

Clausing, Kimberly A., Jonathan M. Colmer, Allan Hsiao, and Catherine Wolfram. The global effects of carbon border adjustment mechanisms. No. w33723. National Bureau of Economic Research, 2025.

European Commission. (2023). Regulation (EU) 2023/956 of the European Parliament and of the Council establishing a Carbon Border Adjustment Mechanism. Official Journal of the European Union, L 130, 52–104.

European Commission. (2025). Report from the Commission to the European Parliament and the Council on the functioning of the European carbon market in 2024. DG TAXUD.

European Commission. (2025). Regulation (EU) 2025/2083 amending Regulation (EU) 2023/956 (CBAM Simplification Regulation). Official Journal of the European Union.

European Commission. (2025, August 28). Call for evidence: CBAM methodology review. DG TAXUD.

OECD. (2025). What to expect from the EU Carbon Border Adjustment Mechanism. OECD Reports, March 2025.

International Aluminum Institute. Global Aluminum Sector Greenhouse Gas Pathways. IAI.

CarbonChain. (2023). EU CBAM excludes indirect emissions — at what cost? CarbonChain Analysis.

South32. Annual Sustainability Reports (various years). Mozal Aluminum Smelter Operations, Mozambique.

Wood Mackenzie. (2023). Global Aluminium smelter asset cost summary. https://www.woodmac.com/reports/metals-global-aluminium-smelter-asset-cost-summary-15723582/