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CBAM: Indirect carbon emissions vs. indirect carbon costs

In July, the European Commission will publish its proposal for a carbon border adjustment mechanism (CBAM). Our understanding is that the mechanism will be designed not only to cover Scope 1 (direct) emissions but also scope 2 (Indirect emissions).

This document looks at the issue of scope 2 emissions in more detail. It focuses exclusively on the difference between indirect emissions and indirect carbon costs and shows how, with a CBAM levied on indirect emissions, European producers will still face unilateral indirect carbon costs. It explains why given the different electricity market designs; only European producers face these indirect carbon costs. It then analyses the proposed Commission methodology to deal with scope 2 emissions and in the process shows that; i) the methodology will only cover indirect emissions, not indirect costs, ii) it will undoubtedly result in carbon free scope 2 emissions plants in Europe (hydro and nuclear based) paying a higher carbon price than fossil fuel emitting plants outside Europe for their output exported to the EU.

The paper argues that indirect costs compensation prescribed in the very recently adopted ETS Guidelines (2020/C 317/04) needs to remain until at least 2030, as a result of the unilateral indirect carbon costs European producers face.

Non-ferrous metals: An electro-intensive sector more exposed to indirect carbon costs

Non-ferrous metals production is extremely electro-intensive. Indeed, electricity represents up to 40% of the cost of the European primary production for our many of our metals, which is substantially higher than most other energy intensive sectors (9,4% for Steel EAF route, 7% for fertilisers and glass, 3% for Steel BOF route, or less than 1% for refineries).[1] From a global perspective, it is worth also noting that the electricity cost for aluminium smelters worldwide accounts for around 32% of their operating costs (significantly lower than for Europeans). As a result, non-ferrous metals are much more exposed to indirect carbon costs than direct carbon costs. For primary aluminium producers, indirect carbon costs are on average seven times greater than direct.

Indirect emissions vs. indirect carbon costs

The draft CBAM proposal aims to put a carbon duty on both scope 1 and scope 2 emissions. In addition, it is intended as a replacement of indirect carbon costs compensation (i.e. financial measures referred to in Article 10a(6) of the ETS Directive). As we explain in the next section, given the difference between indirect emissions and indirect costs, replacing an instrument that duly addresses indirect carbon **costs** with an instrument that seeks to address indirect **emissions** is somewhat perplexing.

There are three different elements which the Commission should take into consideration when looking at a CBAM. These are:

1. **Direct emissions:** The emissions from the production process. The direct emissions multiplied by the EUA price is the same as direct carbon costs.
2. **Indirect emissions:** These refer to the indirect emissions associated with the generation of electricity purchased for an industrial production process. The emissions occur physically at the facility where the electricity is generated but are accounted for in the scope 2 emissions of an industrial product because they are the result of the installation's energy use. **However, they are different from indirect costs.**
3. **Indirect carbon costs:** These refer to the **price effect of CO2 in the electricity market** and **are not an indication of the emissions in the production of for example aluminium**. The power price is set by the marginal power

[1] Detailed information on the non-ferrous metals' electro-intensiveness can be found in the 2019 IES/VUB report: Metals in a Climate Neutral Europe, page 67: here.

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plant in the merit order curve, which is usually coal or gas fired (see figure 2 below). These power plants must purchase emission quotas, which they pass on into the power market. Thus, the power price includes the cost of CO2 even in European countries with a large share of emission-free power production (See more information on the marginal pricing design of the European power markets in the Annex).

Elsewhere, it should be noted that even if a CBAM would effectively include indirect emissions of imports, it will never reflect the indirect carbon costs faced by EU/EEA aluminium producers. In addition, a CBAM level on imports based on indirect carbon content will differ from the CO2 costs passed through in power prices in different regions in Europe (See diagram below for the different pass-through factors).

Indirect CO2 physical emissions are not correlated with indirect CO2 costs

There is a major difference between actual power GHG footprint vs intensity of the price setting technology in the power market (indirect costs).

The Nordic electricity market case study

The Nordic electricity market has almost 100% renewable electricity. However, due to European electricity marginal pricing design, Nordic metals still face a price effect of CO2 (i.e. carbon passthrough) on electricity of 0.67[2]. This means that every time the carbon price increases by €1/tCO2, the power price increases by €0,67/MWh, even if these metals producers consume carbon-free electricity.

Figure 1. Emission intensity, generation and price setting in electricity market

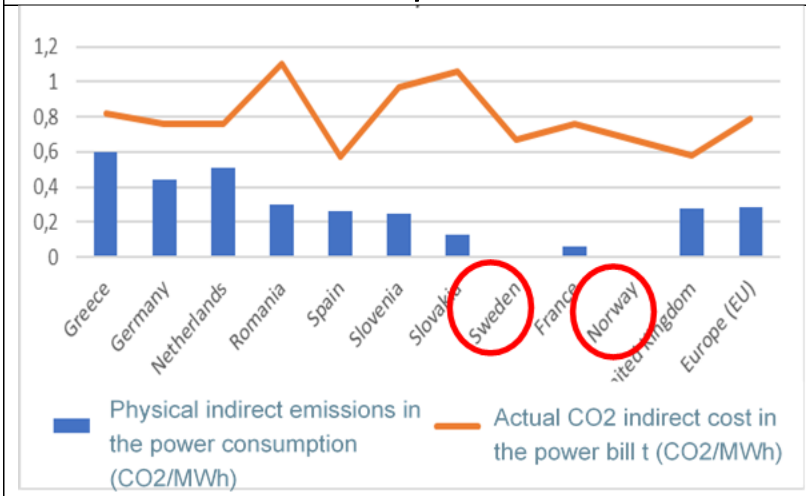
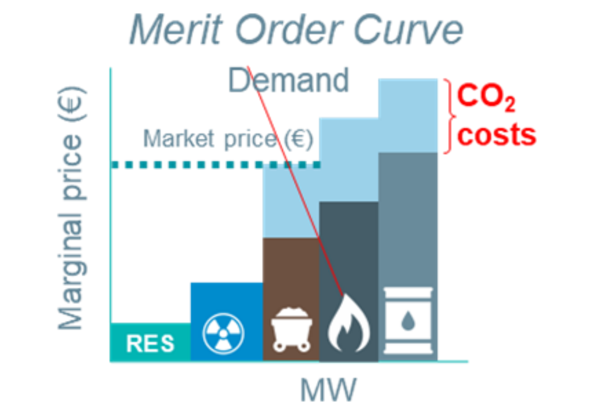


Figure 2. Marginal Pricing design in European Power markets (more info in the annex)



[2] The updated factor for 2021-25 has not yet been published by the Commission. Its publication is expected in Summer 2021

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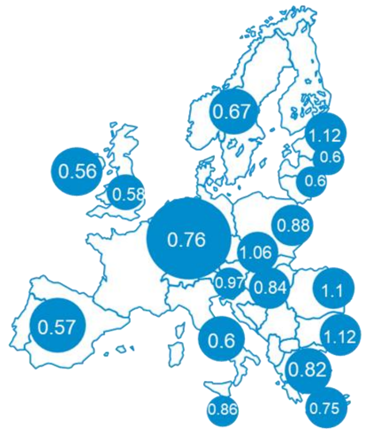
Elsewhere, it is worth noting that there is no EU-wide CO2 pass through value. Coming with an EU wide CO2 passthrough value would assume full power market interconnections and coupling. However, we are nowhere near full power market convergence. Indeed, as the diagram below shows, the CO2 pass through values vary widely in Europe.

CO2 passthrough factors accross Member States



The Commission's potential methodology for calculating Scope 2

In the Commission's CBAM proposal, the Commission may propose to use the average CO2 intensity of the third countries electricity. This will be decided on an annual basis. In addition, there may be a possibility for exporters to the EU to have an individual assessment.

How it could lead even to European plants using carbon free electricity to pay a higher carbon price than third-country exporters using fossil fuels

By focusing only on indirect emissions, and not indirect carbon costs, the Commission's proposed methodology will lead to European aluminium plants powered off nuclear or hydropower facing higher carbon costs than exporters to Europe using fossil fuels.

In order to demonstrate the weakness of the Commission's methodology, we give the example of two aluminium smelters: one operating in Norway using carbon free electricity (hydro power) and one in the United Arab Emirates (UAE) using gas power electricity. For the Norwegian smelter, due to the marginal pricing system in Europe, even though it produces using carbon free electricity, it faces a carbon cost of 0.67 MW/h[3]. This means that for every time the carbon price increase by €1/tonne CO2, the power price increases by €0.67/MWh, even if the plant consumes carbon free electricity.

If we multiply this figure by the amount of MWh needed to produce a tonne of aluminium (We assume 15.12 MWh[4]) by a carbon price of 50 euros a tonne, this will result in Norwegian producers paying a carbon price of 503 euros for every tonne of aluminium. Since the proposal says that this is a replacement of compensation for costs of indirect emissions, no compensation would be given for the 503 euros and thus, Norwegian producers would pay the full cost of the indirect emissions through the power price.

In contrast, if we assume a country like the UAE is powered 100% based on gas[5]. The average CO2 intensity of their electricity would be 0.4 tonnes of CO2 per MWh. This means that for every 1 euro rise in carbon price, their CBAM levy on indirect emissions increases by 0,4€. If we multiply this figure by the same benchmark (15MWh) then an UAE exporter to Europe would have to pay a price of 300 euro a tonne. This figure is 203 euros lower than the carbon price Norwegian producers would have to pay, despite consuming electricity with a significantly higher carbon footprint than the Norwegian smelter[6].

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[3] Reference based on ETS Guidelines values for 2019. The value for Norway for 2020 is expected to be published soon.

4 Average based on International Aluminium Institute figures. For simplicity reasons, we rounded up to 15 MWh in our visuals.

[5] Based on data by the International Aluminium Institute (2020), concerning emissions in the Middle East from electricity electrolysis **here**

[6] Said incremental cost is obviously levied exclusively on the volumes exported to the EU, which is positively non-comparable to the massive increase in the total production cost incurred by EU producers for their total output; in the example above, if the UAE smelter exports 10% of its output to the EU, the added (actual) production cost to the plant would in fact be only 30€/t, compared to the Norwegian smelter's incremental (actual) production cost of 500€/tn. Coupled with the absence of export rebates, the adverse impact on the competitiveness of the EU-based industry is simply colossal.

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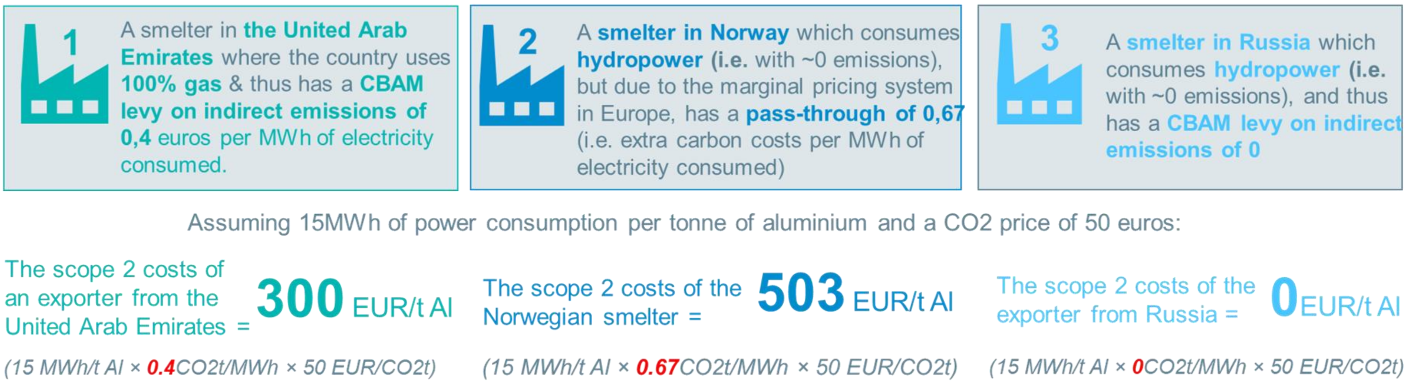
In addition, we give the example of a Russian smelter based on hydropower. If the average electricity intensity is not used and instead, the Russian smelter is able to claim an individual assessment[7], it will pay a carbon price of 0 euro a tonne. In contrast, the Norwegian smelter would pay a carbon cost of 503 euros a tonne. Thus, despite using the same electricity power source, the Russian smelter pays 503 euros lower than the carbon price Norwegian producers would have to pay. In this example, we focus on Norwegian smelters (the same obviously applies e.g., in the case of French smelters based on nuclear power) but the analysis is pertinent for all European smelters, sourcing electricity with a carbon footprint significantly below the relevant pass-through factor (reflecting indirect costs).



Thus, the Norwegian smelter based on hydropower (Who loses his compensation for indirects) would face a higher indirect carbon cost than the gas-based plant the United Arab Emirates and the hydropower plant in Russia

Chinese aluminium smelter challenges

Finally, if we take the example of a Chinese smelter being powered by a coalfired captive plant, thus emitting 1tCO2/MWh[8]. At present, China represents around 60% of the global primary aluminium market. Using the same calculations as above, the Chinese smelter would face 750€/t of CBAM levy. However, a methodology could propose to use the average of the country power mix, which is lower than the smelter's indirect emissions. The country power mix is 0,766C02t/MWh, which would result in a CBAM levy for scope 2 of 574€/t. Therefore, if they use 0% renewable power and 100% coal, then the Chinese exporter based on coal power would still benefit from the average mix at 574€. Thus, the Chinese exporter, even if emitting considerably more than the Norwegian smelter, it would still pay either similar or less carbon costs than the Norwegian smelter[9].

If they choose to export the hydro powered aluminium to Europe (12% of their overall production), given the possibility to make an individual application at installation, they will pay a carbon costs 0€. This is 503 euro less than the Norwegian smelter who is also producing based on hydro power. All this, without considering the resource shuffling options that could be applied (e.g. allocate all low carbon aluminium to Europe, etc), as well as other circumvention possibilities.

[7] This only applies if an individual installation assessment is possible. Electricity generation in Russia is based largely on gas (46%), coal (18%), hydro (18%), and nuclear (17%) power. Thus, average indirect carbon emissions are not zero.

[8] 88% of China's aluminium smelters are run on coal power. 12% are run on hydro power.

[9] Solely for volumes exported to the EU alone, as explained above, not for its entire production, as is the case for the Norwegian smelter, regardless of where it sells its output!

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An Overview of the Scope 2 Global Distortions if Scope 2 emissions were introduced

	Norwegian Smelter	French Smelter	UAE Exporter to Europe	Russian exporter to Europe	Chinese exporter to Europe
Actual indirect Emissions for producing aluminium	**0** indirect tCO2 /t alu	**0,6** indirect tCO2 / t alu	**5,8** tCO2/tAL	**0** indirect tCO2 / t alu (if hydro based)	**13,7** indirect tCO2 / t alu
Country Mix Scope 2 emissions**	**0,017** CO2t/MWh	**0,04** CO2t/MWh	**0,4** CO2t/MWh	**0,384** CO2t/MWh	**0,766** CO2t/MWh
Costs passthrough due to the power market design	**0,67** CO2t/MWh	**0,76** CO2t/MWh	*No electricity market pricing effect*	*No electricity market pricing effect*	*No electricity market pricing effect*
CBAM value for indirect emissions (not costs)	*N/A*	*N/A*	**0,4** CO2t/MWh	**0** CO2t/MWh (if individual assessment)	**1**CO2t/MWh (if coal & actual emissions were used) **0,766** CO2t/MWh (if average used) **0** CO2t/MWh (if hydro & individual assessment)
Scope 2 costs (at 50€/tCO$_2$)	**503** €/t aluminium	**570** €/t aluminium	**300** €/t aluminium	**0**€/t Al (If hydro and individual assessment possible)	**574**€/t aluminium (Coal) **0**€/t aluminium (If hydro and individual assessment possible)
Assessment	**The Scope 2 costs for the Norwegian and French smelters are higher than the costs that would apply to Norway and France's power mix. This is due to the price effect of the European power market design. The ETS State Aid Guidelines correctly factors this price effect**		**The scope 2 costs that the exporter from United Arab Emirates would face via a CBAM levy would be significantly lower than the European smelters' CO2 costs, even if their power mix is not as decarbonised.**	**The exporter from Russia would not face a CBAM levy on scope 2 emissions even if it as the same carbon footprint as the Norwegian smelter.**	**The scope 2 costs that the Chinese exporter would face via a CBAM levy would be at best similar or considerably lower Scope 2 than the Norwegian and French smelters, even if its carbon footprint is clearly higher.**

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Solutions

Indirect costs: While European producers are the only ones to face indirect carbon costs, indirect costs compensation needs to remain. While the current compensation scheme is not optimal[10], it has recently been agreed, it is dynamic to reflect the evolving reality of indirect cost pass-through factors, it contains conditionality incentivizing ambitious decarbonization efforts and should remain in place throughout Phase IV of the EU ETS. Looking ahead, it is important the note that given the excellent progress being made on the decarbonisation of power, we can expect indirect carbon costs to be much less an issue post 2030[11].

ABOUT EUROMETAUX

Eurometaux is the decisive voice of non-ferrous metals producers and recyclers in Europe. With an annual turnover of €120bn, our members represent an essential industry for European society that businesses in almost every sector depend on. Together, we are leading Europe towards a more circular future through the endlessly recyclable potential of metals.

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10 It is partial and voluntary
11 Though indirect costs will still be based on the marginal fuel setting technology, not the average CO2 intensity of the grid mix

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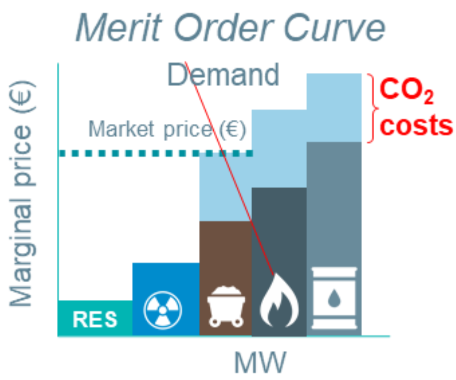
Annex

i. Marginal Pricing in the European Power Markets

European electricity prices are determined by the last supply unit meeting the demand.

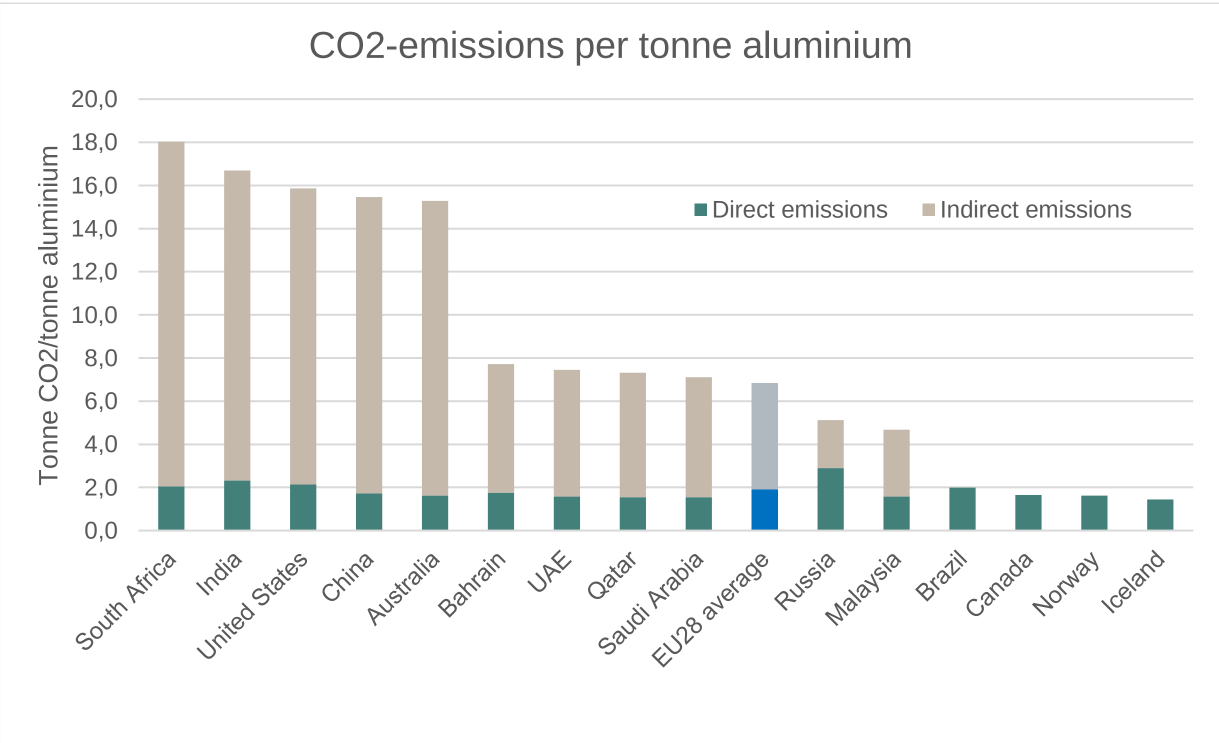
The power generation suppliers are ordered according to ascending marginal costs (i.e., the variable costs). The order is first wind, solar and hydro, nuclear, lignite, hard coal, gas and oil. Unlike other suppliers, renewables cannot decide when to produce and have to sell the entire volume of the electricity they generate. So, they are the ones with the lowest opportunity costs and the first ones brought into the market to meet demand. Since demand is rarely met by the electricity units from the renewables, other sources of electricity with the higher marginal costs come to the market. In most hours, the last electricity unit meeting the demand is fossil-based and will eventually determine the overall price level in the market.



That is to say, regardless of the type of electricity consumed (be it wind, solar, nuclear, gas or coal), the price to be paid is set by the marginal producer (in most cases coal or gas – which has carbon costs embedded)[12].

The aim of such market design was to incentivize power producers to bid their variable costs, which allows them to also recoup their fixed costs during hours when they're not the price setter (i.e. during hours when the market price is higher than their variable cost).

ii. CO2 Emissions per tonne aluminium



[12] In power markets scarcity pricing/price spikes also occur (in fact they are desirable from an electricity market perspective, and likely increasing in frequency, as RES deployment advances), driving prices to levels far higher than variable costs, however, the impact of such events is not assessed for the purpose of this paper.

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iii. Different electricity market designs: Why regions outside Europe do not face indirect carbon costs

The below graph shows how, given the different market designs no regions outside of Europe facing indirect carbon costs

Regions with smelters	Million tonnes (2017)	Carbon regulation	Electricity price impact	Compensation indirect	Net CO2 Cost
Canada	2.9	Yes	No	N.A.	0
CIS	4.0	No	No	N.A.	0
Middle East	5.5	No	No	N.A	0
China	31	Yes	Uncertain	Uncertain, likely full compensation[13]	0
Europe	4.4	Yes	Yes	Partial, degressive & unpredictable	Substantial

iv. Real Life Example: The Husnes Plant

The Husnes aluminium plant in Norway is a clear illustration of the importance of the current indirect costs compensation for our industry. The plant is based on carbon free electricity, so it has no indirect emissions but given the price effect of CO2 in the electricity market still faces indirect carbon costs.

Husnes line B was idled during the financial crisis and now, after 10 years, it has restarted its operations. The decision was finally made the day after the publication of the Indirect Costs compensation Guidelines in Autumn 2020. The reviewed state aid guidelines for indirect carbon costs 2021-2030 were a crucial basis for the reopening decision.

The restart of the B-line at Hydro Husnes represents a NOK 1.5 billion investment in upgrades and the production line holds world-class standards in climate, environmental and operational performance. In addition to doubling the production of aluminum based on renewable energy, the restart of the B-line contributes to almost a hundred new jobs.[14]

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[13] In case an indirects compensation mechanism (e.g. like the one foreseen in EU law) is applied in the country of origin, other than an export rebate linked with carbon pricing, exporters would be eligible for either exemption or full compensation of the CBAM "cost" incurred.

[14] See press release here : https://www.hydro.com/en-CH/media/news/2021/ramp-up-of-husnes-b-line-halfway-milestone-reached/