Home Appliance Europe

Identifying products and sectors at risk of carbon leakage in view of an inclusion into the **Carbon Border Adjustment Mechanism (CBAM)** scope

Summary

- The transitional period of the **Carbon Border Adjustment Mechanism (CBAM)** will expire on 31/12/2025. After that date, the definitive regime will lead to a gradual phasing-out of free **ETS allowances** and a gradual phasing-in of payable CBAM import certificates, for the products listed in Annex I (cement, iron, steel, aluminium, fertilisers, hydrogen, electricity).

- **Article 30** requires the European Commission to assess the risk of carbon leakage for downstream goods, i.e. goods made from the goods already in scope, and to prepare a legislative proposal notably aiming at extending the scope of the CBAM.

- Home appliances (washing machines, fridges, dishwashers, water heaters, etc.) contain a high share of **CBAM-covered raw materials** and compete on a general consumer market with tight profit margins. We call on the European Commission to pay particular attention to the risk of carbon leakage in home appliances.

- We propose the following methodologies to identify products and sectors at **risk of carbon leakage** in view of an inclusion into the CBAM scope. We applied them on a specific product (washing machines) and a specific sector (home appliance manufacturers) in the context of a case-study performed by APPLiA, the European association for home appliance manufacturers.

- On this basis, we propose **3 options** to apply the CBAM price at imports on complex goods.

1. Product-specific methodologies

Methodologies	Main findings
Product-specific methodologies – *Case-study: washing machines*	
CBAM-covered materials intensity in products	• **Typical washing machines are made of around 70% of CBAM-covered materials** (in weight), which indicates a high risk of carbon leakage.

Carbon costs compared to manufacturer's profit margin	• In a 75 EUR carbon price scenario (+/- Q1 2025 levels), washing machine manufacturers bear **an additional production cost of 7.18 EUR per unit** (product profit loss). • In a 120 EUR carbon price scenario (likely future increases): additional production cost of 11.50 EUR per unit. • **Those losses represent approximately the magnitude of the profit margin of an EEA-based washing machine manufacturer** when the washing machine exits the factory (before retail), which indicates a high risk of carbon leakage. • Comparable results were found for dishwashers, air conditioners, fridges and ovens.
Other criteria	• Carbon costs compared to product price (less representative of the risk of carbon leakage than profit margin). • Weight of exports to non-EEA markets. • Product substitution (not relevant for washing machines).
Sector-specific methodologies – *Case-study: home appliance manufacturers*	
Trade intensity (TI)	• **Home appliance manufacturers are highly exposed to international trade** with a TI indicator of 36% i.e. more than motor vehicle manufacturers (28%). • Point of comparison: ETS Phase 3 rules (>30% considered as high exposure to international trade) and other sectors.

1.1 CBAM-covered materials intensity in products

- **(Quantity of CBAM-covered materials included in a product (kg) / weight of the product (kg)) x 100.**

- Resulting in a percentage of CBAM-covered materials compared to full composition of the product.

- Washing machine example: 3.5% aluminium + 26.6% concrete + 30.6% ferro + 9.4% stainless steel = 70.1% of CBAM-covered materials in a washing machine.[1]

[1] Source: APPLiA statistical report https://statreport2023.applia-europe.eu/

1.2 Carbon costs compared to manufacturer's profit margin

- **Quantity of CBAM-covered materials included in a product (kg) x default value emissions per material x carbon price.**

- Resulting in the additional carbon costs generated after the full phasing-out of free ETS allowances and the full phasing-in of CBAM import certificates.

- Can be adjusted to several carbon price scenarios (e.g. yearly average, upper bound estimate in 5 years, etc.)

- Washing machine example:

    - 75 EUR carbon price scenario (March 2025): (22.8 kg of steel x 0.002 tCO2/kg x 75 EUR carbon price) + (3.3 kg of aluminium x 0.0118 tCO2/kg x 75 EUR carbon price) + (3.9 kg of cement x 0.001 tCO2/kg x 75 EUR carbon price) + (0.025 MWh of electricity consumption during production x 0.255 tCO2/MWh x 75 EUR carbon price) = 7.18 EUR additional carbon costs.[2]

    - 120 EUR carbon price scenario = 11.50 EUR additional carbon costs.

- **Most relevant point of comparison: product profit margin of the manufacturer** when the washing machine exits the factory i.e. before retail margins.

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Washing machine made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	22.8	0.002	75	3.42
Aluminium	3.3	0.0118	75	2.92
Cement	3.9	0.001	75	0.29
Total				**6.63 EUR**
Total incl. electricity consumption at production				
Electricity	0.029 MWh	0.255 tCO2/MWh	75	0.55 EUR
				7.18 EUR

Scenario 120 EUR carbon price (possible future increase)

	A	B	C	A x B x C

[2] Source: APPLiA member consultations and desk research.

	Washing machine made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	22.8	0.002	120	5.47
Aluminium	3.3	0.0118	120	4.67
Cement	3.9	0.001	120	0.47
Total				**10.61 EUR**
Total incl. electricity consumption at production				
Electricity	0.029 MWh	0.255 tCO2/MWh	120	0.89
				11.50 EUR

A similar exercise is being carried out by APPLiA with the following CBAM material-intensive products, indicating comparable results (without electricity consumption at production except the last three product):

- **Dishwashers:** 3.75 EUR (75 EUR/tCO2) or 5.99 EUR (120 EUR/tCO2);
- **Air conditioners:** 3.10 EUR (75 EUR/tCO2) or 4.95 EUR (120 EUR/tCO2);
- **Fridges :** 4.12 EUR (75 EUR/tCO2) or 6.60 EUR (120 EUR/tCO2);
- **Ovens :** 5.01 EUR (75 EUR/tCO2) or 8.01 EUR (120 EUR/tCO2).
- **Tumble dryers:** 4.93 EUR (75 EUR/tCO2) or 7.98 EUR (120 EUR/tCO2).
- **Domestic water heater (200L):** 6,34 (75 EUR/tCO2) or 9,86 (120 EUR/tCO2)
- **Domestic hot water heat pump (270L):** 13,53 (75 EUR/tCO2) or 21,65 (120 EUR/tCO2)
- **Tower rail:** 3,54 (75 EUR/tCO2) or 5,66 (120 EUR/tCO2).
- **Electric emitter:** 1,75 (75 EUR/tCO2) or 2,80 (120 EUR/tCO2).

**Detailed calculation for each product can be found in the Annex.*

1.3 Other Criteria

- Consider the weight of exports in total sales, i.e. **percentage of goods produced in the EEA and sold to non-EEA markets.**

- A high weight of exports indicates a risk of carbon leakage in export markets, which could justify a compensation proportionate to the share of export sales.

- Product substitution should also be considered (not relevant for washing machines).

2. Sector-specific methodologies

2.1 Trade intensity (TI)

- **(Exports + imports) / (turnover + imports) x 100.**

- Taken from Art. 10(b)(1) of the ETS Directive, indicates the degree of openness of a sector to international trade. Data available on Eurostat.

- Our findings: 36% TI for home appliance manufacturers, both in 2019 and 2020.
- In Phase 3 of the EU-ETS, a TI exceeding 30% was one of the conditions to be eligible for free allowances.

Year 2019 (source: Eurostat)[3]	
Non-EEA imports in value (€)	15,766,528,191 €
Non-EEA exports in value (€)	9,488,843,666 €
Sum (Imports + Exports)	25,255,371,857 €
Annual turnover	54,336,600,000 €
Total market size (annual turnover + imports)	70,103,128,191 €
TI (Trade Intensity)	**0.36026027 i.e. 36%**

We applied the TI formula on a number of other downstream industries to compare the results of home appliances.

Sector	NACE	Total exports to non EU-27	Total imports to non-EU-27	Annual turnover	TI result	TI (%)
Manufacture of fasteners and screw machine products	25.94	4 919 409 270	5 545 206 372	11 961 100 000	0,597762624	**59%**
Manufacture of other fabricated metal products	25.99	13 302 931 581	14 020 398 818	47 461 100 000	0,44441549	**44%**
Manufacture of other electronic and electric wires and cables	27.32	5 647 576 861	2 762 923 513	31 466 000 000	0,24571326	**24%**
Manufacture of lifting and handling equipment	28.22	19 767 921 183	6 397 127 865	71 548 200 000	0,335684636	**33%**
Manufacture of agricultural and forestry machinery	28.3	12 080 847 535	5 542 364 957	50 000 000 000	0,31729316	**31%**
Manufacture of motor vehicles	29.1	178 728 378 979	76 409 699 210	810 000 000 000	0,28783313	**28%**

[3] Source: Eurostat, 2019 (similar results were found for 2020). Scope: EU-27. Non-EU countries in the EEA (which participate to the EU-ETS and therefore to CBAM) were not available in the dataset.

Manufacture of other parts and accessories for motor vehicles	29.32	51 459 185 108	24 828 609 656	241 346 000 000	0,286608084	**28%**
Manufacture of other transport equipment	30.99	224 137 043	312 344 774	640 000 000	0,563327307	**56%**
Manufacture of electric domestic appliances	27.51	10 749 561 752	17 047 121 815	50 000 000 000	0,414584293	**41%**
Manufacture of other pumps and compressors	28.13	20 954 676 861	9 660 944 015	37 216 600 000	0,6530978	**65%**

3. Applying the CBAM at imports for finished goods

As we assess the risk of carbon leakage in a washing machine based on the carbon costs stemming from its embedded raw materials*, we can then add those costs at imports in one of the following ways (from the simplest to the most sophisticated):

Simple method: default carbon emissions for washing machines
Typical quantity of raw materials in a washing machine (kg, determined by European Commission) x default values per raw material (tCO2/kg, determined by European Commission)

Intermediary method: actual raw material composition with default carbon emissions
Actual quantity of raw materials (kg, reported by importer) x default values per raw material (tCO2/kg, determined by European Commission)

Advanced method: actual raw material composition with actual carbon emissions
Actual quantity of raw materials (kg, reported by importer) x actual emissions per raw material (tCO2/kg, reported by importer)

To facilitate implementation, **the three options should be proposed at least in the first years**.
Importers will pay the carbon price based on one of the three options above.
*Ideally energy consumption (electricity) should also be included.

ANNEX - Cost increase calculations

Dishwasher

Scenario 75 EUR carbon price (March 2025) -

	A	B	C	A x B x C
	Dishwasher made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	23.85	0.002	75	3.58
Aluminium	0	0.0118	75	0
Cement	2.25	0.001	75	0.17
Total				**3.76 EUR**

Scenario 120 EUR carbon price - Dishwasher

	A	B	C	A x B x C
	Dishwasher made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	23.85	0.002	120	5.72
Aluminium	0	0.0118	120	0
Cement	2.25	0.001	120	0.27
Total				**5.99 EUR**

Air conditioners

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Air conditioners made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	4.28	0.002	75	0.64
Aluminium	2.77	0.0118	75	2.45
Total				**3.10 EUR**

Scenario 120 EUR carbon price (March 2025

	A	B	C	A x B x C
	Air conditioners made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	4.28	0.002	120	1.03
Aluminium	2.77	0.0118	120	3.92
Total				**4.95 EUR**

Fridges

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Fridges made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	21.09	0.002	75	3.16
Aluminium	1.08	0.0118	75	0.95
Total				**4.12 EUR**

Scenario 120 EUR carbon price (March 2025

	A	B	C	A x B x C
	Fridges made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	21.09	0.002	120	5.06
Aluminium	1.08	0.0118	120	1.53
Total				**6.60 EUR**

Ovens

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Ovens made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	25.25	0.002	75	3.79
Aluminium	1.38	0.0118	75	1.22
Total				**5.01 EUR**

Scenario 120 EUR carbon price

	A	B	C	A x B x C
	Ovens made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	25.25	0.002	120	6.06
Aluminium	1.38	0.0118	120	1.95
Total				**8.01 EUR**

Tumble dryers

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C

	Tumble dryers made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	19.32	0.002	75	2.90
Aluminium	2.3	0.0118	75	2.03
Total				**4.93 EUR**

Scenario 120 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Tumble dryers made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	19.32	0.002	120	4.64
Aluminium	2.3	0.0118	120	3.26
Total				**7.98 EUR**

Domestic water heater (200L)

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Domestic water heater (200L) made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	38.82	0.002	75	5.82
Aluminium	0	0.0118	75	0
Total incl. electricity consumption at production				
Electricity	0,0178	0,255tCO2/MWh	75	
Total				**6.34 EUR**

Scenario 120 EUR carbon price

	A	B	C	A x B x C
	Domestic water heater (200L) made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	38.82	0.002	120	9.32
Aluminium	0	0.0118	120	0
Total incl. electricity consumption at production				
Electricity	0,0178	0,255tCO2/MWh	120	0.54
Total				**9.86 EUR**

Domestic hot water heat pump (270L)

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C

	Domestic hot water heat pump (270L) in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	72.75	0.002	75	10.91
Aluminium	2.70	0.0118	75	2.39
Total incl. electricity consumption at production				
Electricity	0.0121	0,255tCO2/MW	75	0.23
Total				**13.53 EUR**

Scenario 120 EUR carbon price

	A	B	C	A x B x C
	Domestic hot water heat pump (270L) made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	72.75	0.002	120	17.46
Aluminium	2.70	0.0118	120	3.82
Total incl. electricity consumption at production				
Electricity	0.0121	0,255tCO2/M	120	0.37
Total				**21.65 EUR**

Towel rail

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Towel rail made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	22.03	0.002	75	3.30
Aluminium	0	0.0118	75	0
Total incl. electricity consumption at production				
Electricity	0.0121	0,255tCO2/M		0.23
Total				**3.54 EUR**

Scenario 120 EUR carbon price

	A	B	C	A x B x C
	Towel rail made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	22.03	0.002	120	5.295
Aluminium	0	0.0118	120	0
Total incl. electricity consumption at production				
Electricity	0.0121	0,255tCO2/M		0.37
Total				**5.66 EUR**

Electric emitter

Scenario 75 EUR carbon price (March 2025)

	A	B	C	A x B x C
	Electric emitter made in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	4.122	0.002	75	0.62
Aluminium	1.02	0.0118	75	0.90
Total incl. electricity consumption at production				
Electricity	0.0121	0,255tCO2/M		0.23
Total				**1.75 EUR**

Scenario 120 EUR carbon price

	A	B	C	A x B x C
	Electric emitter in the EEA (quantity per unit, kg)	Average total CO_2 emissions (tCO_2 / kg) default values	EUA carbon price (€ / tCO_2)	Cost increase (€)
Steel	4.12	0.002	120	0.99
Aluminium	1.0	0.0118	120	1.44
Total incl. electricity consumption at production				
Electricity	0.012	0,255tCO2/M	120	0.37
Total				**2.80 EUR**