

EU CBAM Implementation Guide

Technical Blueprint & Calculations for Indian MSME Shop Floors

Setting up a CBAM-compliant system from scratch can feel overwhelming, but it follows a logical engineering process. Under the definitive rules, the calculation must determine the **Specific Embedded Emissions (SEE)**—the exact weight of greenhouse gases emitted per single metric tonne of your final product.

This deep dive breaks down the math, boundary lines, and technical setup required for an Indian MSME shop floor.

Part 1: Setting Up Your Installation Monitoring Plan

Your Monitoring Plan is a comprehensive map of your factory's energy inputs. It must be a living document written in English that defines exactly where your data comes from.

Step 1: Define Your "System Boundaries"

You must isolate the specific machinery making the exported goods from the rest of your facility. Draw a clear perimeter line around the operational area.

- **Include:** Furnaces, rolling mills, finishing lines, internal forklifts transporting raw materials, and on-site electricity substations.
- **Exclude:** Administrative blocks, executive offices, employee canteens, and outbound delivery trucks.

Step 2: Identify "Source Streams"

List every single input material or fuel that crosses your system boundary and releases carbon when consumed. For an engineering MSME, this typically looks like:

- **Combustion Streams:** Diesel for generators, natural gas or coal for furnaces.
- **Process Streams:** Carbon electrodes that wear down during electric arc melting, or limestone used as a flux.
- **Material Inputs (Precursors):** The raw steel billets or aluminum ingots you purchase from upstream suppliers.

Step 3: Establish Data Control Points

For every source stream, your plan must document the Activity Data (how much you used) and the tracking method:

- Fuel inputs must be tracked via utility invoices, calibrated flow meters, or weighbridge receipts.
- Data intervals must be standardized—continuous tracking compiled into strict monthly summaries.

Part 2: Calculating Direct Emissions (Scope 1)

Direct emissions are the greenhouse gases physically released on your factory floor. To calculate them, use the Standard Calculation-Based Approach.

The Formula

For every fuel or raw material consumed, use this basic equation:

$$\text{Direct Emissions (tCO}_2\text{)} = \text{Activity Data} \times \text{Emission Factor} \times \text{Oxidation Factor}$$

Where:

- **Activity Data:** The quantity of fuel or material consumed (measured in Tonnes or Terajoules (*TJ*)).
- **Emission Factor (*EF*):** The amount of CO_2 released per unit of fuel. You should use standard values from the Intergovernmental Panel on Climate Change (IPCC) or national inventories if laboratory tests are unavailable.
- **Oxidation Factor:** The percentage of fuel that actually burns (default to 1.0 or 100% unless you have audited chemical ash data proving incomplete combustion).

Step-by-Step Shop Floor Execution

- **Collect Fuel Data:** Check your internal logs. Suppose your reheating furnace burned 50,000 standard cubic meters (*scm*) of natural gas over the production period.
- **Convert to Energy Units (*TJ*):** Multiply the volume by the Net Calorific Value (*NCV*) provided on your GAIL or local gas utility invoice.
- **Apply the Factor:** Multiply the energy total by the specific CO_2 factor for natural gas to find your total metric tonnes of direct CO_2 (*tCO₂*).

Part 3: Calculating Indirect Emissions (Scope 2)

Indirect emissions represent the carbon footprint of the electricity you purchase from the state power grid to run your machinery (such as electric motors, CNC machines, and cooling systems).

Sector Check: The EU calculates indirect emissions for Cement, Fertilisers, and Hydrogen. For Iron, Steel, and Aluminium, indirect emissions are closely monitored but are currently exempt from border certificate costs to prevent double-counting with European energy rules. However, you must still track and report this data.

The Formula

$$\text{Indirect Emissions (tCO}_2\text{)} = \text{Electricity Consumed (MWh)} \times \text{Grid Emission Factor}$$

Step-by-Step Shop Floor Execution

- **Log Total Consumption:** Pull your monthly state electricity board (e.g., MSEDCL, TANGEDCO, UPPCL) utility bills. Isolate the exact megawatt-hours (*MWh*) supplied to your production line.
- **Determine the Grid Emission Factor:** The EU does not allow you to use a generic global average. You must use the official grid factor for India published annually by the Central Electricity Authority (CEA) under the Ministry of Power.
- **Apply the Math:** Multiply your total annual *MWh* by the CEA grid factor (historically hovering around 0.71 to 0.79 *tCO₂ / MWh*, depending on the regional grid mix and coal reliance).
- **Green Energy Deduction:** If your factory uses on-site rooftop solar panels or buys wind power through a direct, verified Power Purchase Agreement (PPA) with a clean energy provider, you can safely apply an emission factor of 0 for that specific portion of your power.

Part 4: Consolidating to Specific Embedded Emissions (*SEE*)

Once you have calculated your total direct and indirect emissions, you must combine them and divide the sum by your total output volume to find the final number your EU buyer needs.

The Final Equation

$$SEE = \frac{\text{Direct Emissions} + \text{Indirect Emissions} + \text{Emissions of Precursors}}{\text{Total Tonnes of Product Produced}}$$

Step-by-Step Consolidation

- **Account for Precursors:** If you manufacture steel bolts, you must contact the mill that sold you the raw steel wire. Ask for their verified CBAM data sheet. Add their emissions per tonne multiplied by the volume of wire you consumed.
- **Aggregate:** Add your factory's total Direct tCO_2 + Indirect tCO_2 + Precursor tCO_2 .
- **Divide by Yield:** Divide that final number by the net weight of the finished, sellable products that rolled off your line during the audit period.

The resulting figure (tCO_2 per tonne of product) is the clean, verified metric you will upload to the EU O3CI Portal to secure your European trade pipeline.