POLICY BRIEFING

Beyond the Border: EU climate ambition through the lens of embedded emissions

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The Traded Emission Tracker

This brief is constructed around the findings of the **Traded Emissions Tracker**, a newly launched web platform developed by the European Climate Foundation (ECF) and the climate consultancy Matière that provides a visual overview of emissions linked to international trade covering the period from 2010 to 2023.

Most climate statistics report emissions where they are physically released. Yet in a globalised economy, a large share of what we consume is produced abroad, generating emissions in the production country and not only the country of consumption. The tool's purpose is to make this consumption-based perspective tangible and clear to inform trade and climate policy.

The greenhouse gas (GHG) emissions embodied in international trade are presented visually, broken down by country, gas and sector. This includes the proportion of a country's (or group of countries') carbon footprint that is imported (emissions generated abroad for goods and services consumed domestically) and exported (emissions generated domestically for goods and services consumed abroad).

The tracker and its methodology can be accessed here:
https://emissions.netzerotrade.org/

Key findings

- ✓ The EU's overall GHG footprint (production emissions + imported emissions – exported emissions) ranks 4th globally after China, the US and India for a total of 4.0 billion tonnes of CO2 equivalent — 21% higher than emissions produced within its borders.
- ✓ The EU is the third most important emissions importer with 1.4 billion tonnes generated abroad. It also the third most important exporter, for a total of almost 20% of global emissions embodied in trade.
- ✓ Power generation and mining & fossil gas extractions are the largest contributors to the EU's imported emissions.
- ✓ The European Climate Law and the EU Emissions Trading System are built almost entirely around territorial (production-based) emissions, leaving out the growing share of emissions embedded in imported goods.
- ✓ A credible EU climate framework for the post-2030 period should formally integrate consumption-based indicators, strengthen and extend border and due-diligence instruments, and pair these with demand-side and international cooperation measures.

1. Introduction

Over the past three decades, the European Union has built one of the world's most comprehensive climate governance architectures. The European Climate Law enshrines a legally binding target of climate neutrality by 2050, with intermediate reductions of 55% and 90% in net greenhouse gas emissions by 2030 and 2040 compared with 1990 levels. These targets are underpinned by the EU Emissions Trading System, the Effort Sharing Regulation, and a wide array of sectoral legislation adopted under the European Green Deal and the Clean Industrial Deal.

Yet all of these instruments share a common structural feature: they measure and regulate emissions produced within EU territory. This 'territorial' or 'production-based' accounting approach, inherited from the UNFCCC national inventory system, tells only part of the story of the EU's true contribution to global warming. It says nothing about the greenhouse gases released elsewhere in the world to manufacture the goods that Europeans import and consume — from textiles and electronics to steel, food and construction materials. As European industry has become more efficient including through, at times, offshored emissions-intensive production abroad, a growing share of the climate impact of European consumption has simply moved outside the perimeter that EU climate law measures and regulates.

This is the essence of 'embedded' (or 'consumption-based' emissions): the emissions generated throughout the entire global production chain of a good or service, attributed not to the country where they are physically released, but to the country where the good is ultimately consumed. Such emissions can be embedded in imports or exports of a given territory, in this case the EU.

Since the 1990s, global CO_2 emissions have risen by roughly two-thirds while the EU's domestic emissions have fallen by close to a third — an apparent success story that becomes considerably more ambiguous once trade is taken into account. Because the EU imports substantially more embedded emissions than it exports, it is a persistent net importer of carbon: a meaningful share of the environmental cost of European lifestyles is, in effect, exported to producer countries, many of them with fewer resources to decarbonise and weaker climate regulation.

This is not a marginal accounting nuance. Eurostat estimates that the EU's consumption-based greenhouse gas footprint routinely exceeds its production-based emissions by around a fifth, and independent research suggests that a little over half of the environmental impacts associated with EU consumption — across climate, biodiversity and resource-use indicators — already occur outside the Union's borders. A climate framework calibrated only to territorial emissions therefore risks rewarding accounting improvements — offshoring, import substitution, structural shifts away from heavy industry — that leave the EU's actual global climate footprint unchanged, or even

rising, while declaring domestic 'success'. It also sits awkwardly alongside the EU's stated ambition, expressed through instruments such as the Carbon Border Adjustment Mechanism (CBAM) and the Deforestation Regulation, to ensure its market does not fuel emissions or environmental degradation abroad.

An EU climate framework built on the European Climate Law and EU ETS alone is therefore structurally incomplete. It cannot fully capture, incentivise the reduction of, or hold the EU accountable for the emissions caused by its own consumption when those emissions occur beyond its borders. Bringing embedded emissions systematically into EU climate governance — through better measurement, complementary targets, and coherent trade, product and diplomatic instruments — is a precondition for the EU to credibly claim global climate leadership. This brief sets out the evidence for that case, benchmarks the EU's embedded-emissions profile against those of the United States and China, and proposes a set of policy recommendations for embedding this perspective more fully in the EU's post-2030 climate architecture.

2. The scale of the problem: EU embedded emissions in global perspective

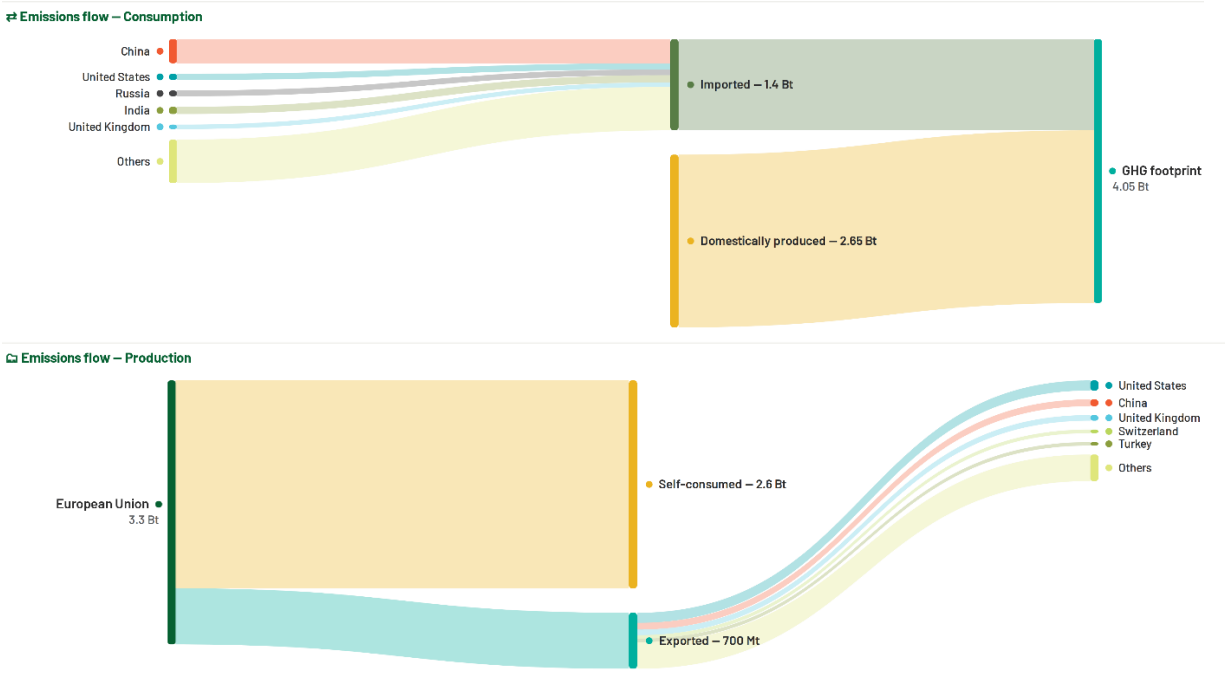
2.1 The EU's consumption footprint

The emissions generated throughout the global production chains of all goods and services consumed within the European Union, wherever those emissions physically occur — stood at 4.05 billion tonnes of CO_2 equivalent in 2023. This is 21% higher, in both absolute and per capita terms, than the 3.3 billion tonnes of CO_2 equivalent the EU produces within its own territory. Of the EU's total footprint, around 1.4 billion tonnes — more than a third — originated outside the Union, and therefore represent its imported emissions.

This makes the EU the world's third-largest importer of emissions, accounting for 12.5% of global emissions embodied in trade, which represent 2.7% of global emissions. China and the US are the world's two largest importers of emissions, accounting for 1.62 and 1.61 billion tonnes of CO_2 equivalent respectively – or around 15% each of total imported emissions globally. Meanwhile 0.7 billion tonnes of CO_2 equivalent are embedded in EU exports, the third highest total globally after China and Russia. The US is the largest destination for these exported emissions, accounting for 18%, followed by China (12%) and the United Kingdom (10%) (figure 1).

On a per capita basis, the EU's carbon footprint stood at 9.0 tonnes of CO_2 equivalent per person in 2023, down from 10.0 tonnes the previous year, but still substantially above the EU's territorial per capita emissions of 7.4 tonnes (table 1).

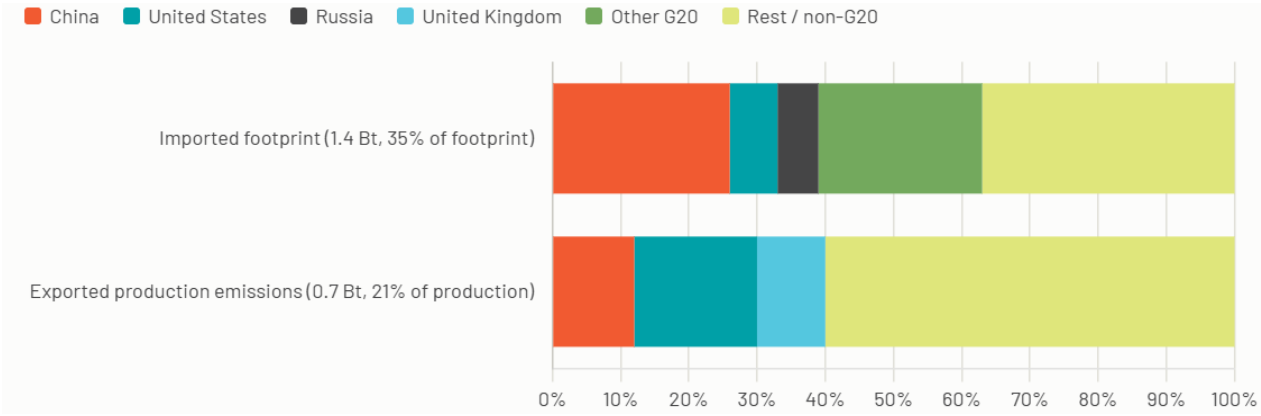
Figure 1: EU domestic, imported and exported embedded emissions ($MtCO_2eq.$, 2023)



Source: Traded Emission Tracker

The geography of EU imported emissions is heavily concentrated. Among G20 trading partners, China alone accounted for around 370 million tonnes of CO_2 equivalent, or roughly a quarter of the extra-EU emissions embedded in EU consumption in 2023, followed by the United States (some 95 million tonnes) and Russia (around 88 million tonnes) — though Russia's share has fallen sharply since 2022 as EU-Russia trade has been curtailed. More than a third of the EU's imported footprint originates in non-G20 countries, many of them low- and middle-income economies with limited capacity to decarbonise their export industries (Figure 2).

Figure 2: Trading partners behind the EU's imported vs exported embedded emissions, 2023



Source: Traded Emission Tracker

The pattern is highly uneven across Member States. In relative terms, Malta's imported emissions are estimated at roughly five times its domestic emissions, and Latvia and Belgium's emissions embedded in imports also exceed their entire domestic footprint.

By contrast, net exporters of embedded emissions such as Greece, Bulgaria and Poland show negative embedded-trade balances. National case studies compiled by IEEP and the Stockholm Environment Institute illustrate the same pattern at country level: in Denmark, roughly half of consumption-based emissions originate abroad, notwithstanding a domestic Climate Act principle against exporting emissions beyond its borders; in Sweden, 60% of the country's consumption footprint is generated overseas despite a two-decade-old 'Generational Goal' explicitly ruling this out; and in France, more than half of consumption-based emissions are now imported, with imported emissions rising by roughly a third since 1995 even as domestic emissions fell by a similar margin over the same period.

2.2 How the EU compares with the United States and China

Placed alongside the world's other two largest economies, the EU's position is that of a net importer of embodied carbon – like the US – while China sits at the opposite end of the spectrum as the world's largest net exporter of embedded emissions (table 1)

Table 1: comparison of production- and consumption-based emissions profiles, EU–US–China (2023)

Indicator	European Union	United States	China
Trade position of embedded emissions	Net importer	Net importer	Net exporter
Total consumption footprint	▪ 4.0 billion tCO_2e, ▪ 8% of global emissions ▪ 4th overall footprint, 3rd emission importer and 3rd exporter.	▪ 6.9 billion tCO_2e ▪ 14% of global emissions ▪ 2nd overall footprint, 2nd emission importer and 4th exporter.	▪ 14.1 billion tCO_2e ▪ 28% of global emissions ▪ 1st overall footprint, 1st emission importer and 1st exporter.
Overall GHG footprint	21% higher than territorial emissions	17% higher than territorial emissions	9% lower than territorial emissions
Production-based emissions per capita	7.4 tCO_2e	17.5 tCO_2e	10.9 tCO_2e
Consumption-based emissions per capita	9.0 tCO_2e	20.5 tCO_2e	10.0 tCO_2e
Domestic climate framework	European Climate Law: -55% GHG emissions by 2030, -90% (net) by 2040, net zero by 2050; Territorial basis	NDC suspended but prev.: - 61 to 66% emissions (net) by 2035; Territorial basis	NDC: 7–10% below peak levels by 2035, "striving to do better", carbon neutrality by 2060; Territorial basis

Source: Compiled from Traded Emission tracker, Eurostat environmental accounts (2023), Global Carbon Project/Our World in Data consumption-based CO_2 series, and UNEP Emissions Gap Report 2024 estimates.

The United States, like the EU, is a long-standing net importer of embedded carbon: its territorial emissions have been comparatively stable to slightly rising since 1990, but once trade is accounted for, the increase is more pronounced, reflecting sustained imports of manufactured goods — particularly from China and other Asian manufacturing hubs. On a per capita basis, US production-based emissions (17.5 tonnes of CO_2 equivalent) are already among the highest of any major economy, and its consumption-based footprint runs higher still, placing average US consumption emissions well above EU levels on a per-person basis, even though the EU's total population and economy are of comparable scale.

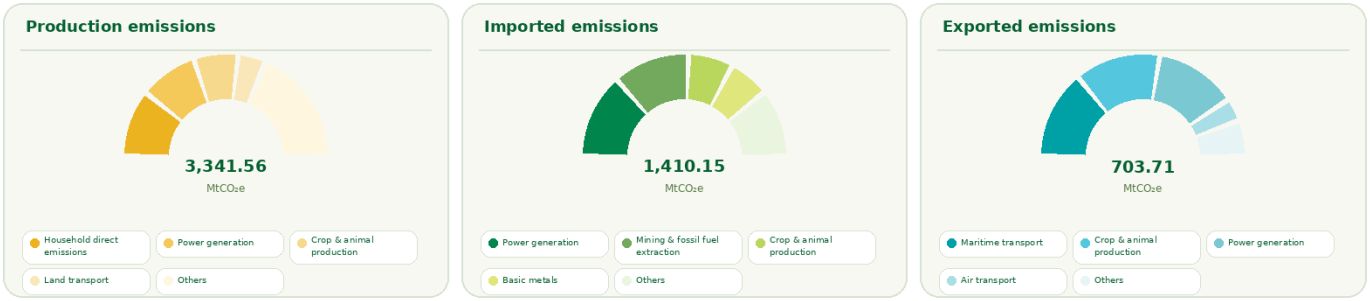
China presents the mirror image. As the world's largest territorial emitter — accounting for a substantial share of both global emissions and global manufacturing output — China is also by far the world's largest net exporter of embedded emissions (27% of the total), while the second-largest exporter, Russia, stands at 7%. A substantial share of China's domestic industrial emissions are generated to satisfy final demand elsewhere, notably in the EU and the US. This means China's consumption-based footprint is consistently estimated to be below its production-based emissions, by a margin that, while narrowing over time as China's own domestic consumption grows, remains substantial. Chinese per capita production emissions (10.9 tonnes of CO_2 equivalent) sit between EU and US levels, but because so much production is destined for export, per capita consumption emissions are markedly lower.

The comparison underscores an important asymmetry in global climate governance: countries that appear to be making the fastest progress on territorial decarbonisation — including the EU — are often simultaneously importing a growing share of their true climate footprint from countries with more carbon-intensive energy mixes. Left unaddressed, this dynamic allows apparent climate leadership to coexist with, or even be partly built upon, a rising global footprint.

2.3 Which sectors stand out?

Not all consumption categories contribute equally to the EU's climate footprint. Analysis of trade-related spillovers from EU final demand — compiled from the Traded Emission Tracker but confirmed through other independent research from JRC and SDSN notably— consistently identifies a relatively small number of consumption categories as disproportionate drivers of embedded greenhouse gas emissions (figure 3).

Figure 3: EU emissions, production, importer and exported emissions by sectors (2023)



Source: Traded Emission Tracker

In terms of imported emissions, power generation stands first, representing 27% of total EU imported emissions, with mining and fossil fuel extraction following closely with 24.4%. This is consistent with previous research identifying fossil gas extraction as a top contributor, an outcome of the EU's continued reliance on imported gas even as domestic production has declined.

Taken together, the sectoral evidence suggests that the EU's imported emissions problem are not diffuse across the whole economy but concentrated in a limited number of identifiable value chains. This concentration makes targeted policy intervention – through product regulation, trade instruments and due diligence requirements – both feasible and potentially high-impact.

3. Policy recommendations: towards a climate framework that accounts for embedded emissions

The EU already has a foundation of internationally facing instruments to draw on. The Carbon Border Adjustment Mechanism (CBAM) puts a carbon price on selected imported industrial goods; the Ecodesign for Sustainable Products Regulation (ESPR) and the forthcoming Circular Economy Act target the resource- and material-intensity of products; the Deforestation Regulation, the Forced Labour Regulation and the Corporate Sustainability Due Diligence Directive address specific environmental and social harms embedded in supply chains; and the 8th Environment Action Programme lists reduced material and consumption footprints among its enabling conditions for 2030. What is missing is not a lack of building blocks but their integration into a coherent, binding, and adequately ambitious framework anchored in the EU's core climate law. IEEP proposes five priority actions.

1. Embed consumption-based indicators in the EU's core climate governance

The European Climate Law, the 2040 climate target framework, and the EU's National Energy and Climate Plans should formally incorporate consumption-based greenhouse gas indicators — already compiled annually by Eurostat — as a complementary, tracked metric alongside territorial targets. This would not require replacing the EU's binding

2030, 2040 and 2050 territorial targets, which remain essential and legally grounded in the Paris Agreement's national-inventory architecture. It would instead mean the Commission and Member States are required to report, monitor and set direction-of-travel ambitions for the consumption footprint, following the logic already used for material and consumption footprints under the 8th Environment Action Programme, but with greater visibility, regularity and political weight.

2. Make access to the European market conditional on carbon content

- Proceed with the Commission's proposed expansion of CBAM's product scope from 2028 onwards and use the mechanism's 2028 statutory review to assess extending coverage to downstream and consumer-facing products in the highest-spillover sectors.
- Align the phase-out of free allocation under the EU ETS with CBAM's expanding scope, to avoid a widening gap between sectors facing a full carbon price and those still shielded from it.
- Explore complementary measures for sectors that are structurally difficult to cover through a border carbon price alone, such as fossil gas imports, including strengthened methane and lifecycle-emissions reporting requirements for imported energy.

3. Sharpen product and due-diligence legislation to target the highest-spillover sectors

- Ensure the Circular Economy Act's headline circularity target is paired with, rather than substituted for, an explicit and binding material footprint or consumption-footprint reduction objective, since a rising circular material use rate can still coexist with growing absolute material and emissions throughput.
- Strengthen monitoring of the Corporate Sustainability Due Diligence Directive and the Deforestation Regulation specifically for their contribution to reducing embedded emissions, not only their primary biodiversity and human-rights objectives, given the overlap identified between high-spillover sectors for climate, deforestation and water stress.
- Continue prioritising ESPR delegated acts toward the sectors with the largest identified embedded-emissions footprint (e.g. textiles and apparel, furniture, and construction products).

4. Address the demand side: sufficiency, durability and public procurement

- Develop, at EU and Member State level, targeted demand-reduction and sufficiency policies for the highest-impact consumption categories — building on measures such as extended producer responsibility, right-to-repair rules, and restrictions on the destruction of unsold goods — rather than relying solely on production-side

efficiency improvements, which recent trends show have not been sufficient to offset rising consumption volumes.

- Make full use of Green Public Procurement to shift public-sector demand toward lower-embedded-emissions products, particularly in construction and vehicles, two sectors where public purchasing power is significant.
- Support Member States that wish to pilot or scale up local and national consumption-based targets — following examples from Swedish municipalities — with EU-level technical and methodological support, to build a body of practical experience ahead of any future EU-wide target.

5. Invest in measurement infrastructure and international cooperation

- Reduce the reporting lag in EU consumption-based emissions accounts — currently compiled with a delay relative to territorial inventories — by resourcing Eurostat, the European Environment Agency and the Joint Research Centre to deliver more timely, granular, and sector-disaggregated footprint data, including at Member State and, where feasible, regional level.
- Pair any strengthening of EU border and product measures with genuine cooperation and support for trading partners' decarbonisation — through instruments such as critical raw materials partnerships, climate finance, and technology transfer — to ensure the EU's pursuit of its own footprint reduction does not simply displace the burden of adjustment onto exporting countries in the Global South without support.
- Use the EU's trade policy architecture, including Trade and Sustainable Development chapters in Free Trade Agreements, to promote comparable measurement and disclosure of embedded emissions among key trading partners, building the data foundation for future international coordination on consumption-based accounting.

6. Conclusion

The EU's climate framework has delivered real and measurable reductions in territorial emissions over more than three decades. But territorial accounting, by design, is blind to a structural feature of a modern, trade-integrated economy: a rising share of the climate cost of European consumption is generated beyond the EU's own borders. With a consumption footprint some 21% above its production-based emissions, and more than half of its broader environmental impact already occurring outside its territory, the EU cannot credibly consider its climate accounts settled by focusing on domestic emissions alone. Nor can it fully claim the mantle of global climate leadership while a substantial share of its true footprint is, in effect, outsourced to trading partners with fewer resources and often weaker regulatory capacity to manage the resulting emissions.

The comparison with the United States and China illustrates that this is not a uniquely European dilemma, but a structural feature of how global trade and climate accounting interact — and one that a genuinely ambitious EU can help to resolve rather than simply live with. The building blocks already exist within EU policy: the Carbon Border Adjustment Mechanism, the Ecodesign for Sustainable Products Regulation, the emerging Circular Economy Act, and a suite of supply-chain due diligence instruments each address a piece of the embedded-emissions puzzle. What is required now is the political will to integrate these instruments around a shared, measurable objective — anchored in the EU's core climate law — of reducing the Union's full climate footprint, wherever in the world it is generated. Doing so would not only close a long-standing gap in EU climate governance; it would substantially strengthen the credibility of the EU's claim to be a first mover in the global, and genuinely fair, transition to net-zero.

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