

Tracing the Carbon Footprint of Steel in Türkiye:

Production, Consumption and Trade Linkages

Executive Summary

TRACING THE CARBON FOOTPRINT OF STEEL IN TÜRKİYE: PRODUCTION, CONSUMPTION AND TRADE LINKAGES - EXECUTIVE SUMMARY

Decarbonising the steel sector is a key area where the energy transition intersects with industrial and trade policy. The energy and raw materials used in steelmaking, together with the use of steel in sectors such as construction, automotive manufacturing and machinery, extend the implications of this transition beyond production facilities. Understanding steel's carbon footprint therefore requires an assessment of supply chains, international trade and final demand alongside production processes.

TÜRKIYE'S POSITION IN STEEL VALUE CHAINS AND THE NEED FOR TRANSFORMATION

Türkiye is one of the world's leading steel producers and is closely integrated into global steel value chains through imports, exports and the use of intermediate inputs. Steel produced in Türkiye is exported both directly and as an input embedded in other industrial products. Imported steel supports domestic consumption as well as production and exports. The transformation of Türkiye's steel sectors therefore depends on energy supply, international input sourcing and decisions in steel-using sectors, alongside the technological performance of domestic facilities.

The scale of industrial trade with the European Union (EU) and the inclusion of iron and steel products within the scope of its Carbon Border Adjustment Mechanism (CBAM) further increase the importance of the carbon performance of Türkiye's steel production and the need for information on its production chains. However, emissions embedded in steel are not limited to steel products exported directly to the EU. Trade in products from steel-using sectors and the use of imported inputs in domestic production extend steel's carbon linkages across a broader economic and geographical area.

The establishment of an implementation framework for Türkiye's Emissions Trading System (ETS) marks a new stage in the decarbonisation of its steel sectors under domestic climate policy. Following the entry into force of the Climate Law in 2025, the Türkiye ETS Regulation was published on 27 August 2026, setting out the procedures and principles governing the system's pilot implementation. The pilot period covers emissions in 2026 and 2027 and includes iron and steel facilities exceeding the specified thresholds. While obligations for 2026 primarily concern reporting, allowances corresponding to 2027 emissions must be surrendered in 2028 (Directorate of Climate Change, 2026a, 2026b).

The regulation governing the operation of Türkiye's ETS market, published on 21 October 2026, also established rules for the allowance market and transaction registry (EPDK, 2026). Türkiye's ETS and CBAM increase the importance of information on the carbon performance of steel production through distinct regulatory frameworks. Türkiye's ETS focuses on emissions from covered domestic facilities, while CBAM addresses the embedded emissions of specified products imported into the EU, as defined within its regulatory scope.

The transformation needs of Türkiye's steel sectors should be assessed in conjunction with the energy, supply and trade linkages extending beyond production facilities. Direct facility emissions capture an important dimension of steel production but exclude emissions arising from the production of purchased electricity, fuels, raw materials and other intermediate inputs. Similarly, examining trade in steel-sector products alone does not fully capture the flows through which steel, embedded in products from other sectors, reaches producing sectors and final demand in domestic and international markets.

Identifying opportunities for steel decarbonisation therefore requires a joint assessment of where emissions arise along production chains, which sectors use steel and which economies' demand is served by domestic and foreign steel production. This approach reveals the connections between emissions reductions at facilities and decisions concerning energy supply, input sourcing and steel use.

Scope and approach of the study

This report examines Türkiye's steel-related carbon footprint by bringing together production, consumption and trade perspectives. It focuses on the manufacture of basic iron and steel and ferro-alloys (basic steel) and the reprocessing of secondary steel into new steel (secondary steel) in Türkiye. It calculates the direct and

supply chain emissions associated with these activities and traces the economies whose demand is served by steel and steel-containing products, together with their embedded emissions.

The study's contribution lies in identifying the asymmetry between Türkiye's steel production and consumption and relating this difference to its net trade balance in embedded carbon. It separately calculates the allocation of Türkiye-produced steel between domestic final demand and exports and the contribution of foreign steel production to Türkiye's final demand and re-exports. Comparing the imported steel footprint retained in domestic final demand with the export-bound footprint of Türkiye-produced steel helps explain the difference between production and consumption footprints through trade linkages.

The central asymmetry in Türkiye's steel value chains is that domestic production is predominantly export-oriented, while domestic final demand relies heavily on foreign steel production linkages. Despite being a major steel producer and exporter, Türkiye is a net importer of steel-related embedded carbon. The re-export of imported steel after processing in Türkiye also reveals the country's role as an intermediate production hub in international steel value chains.

The analysis uses the 2022 industry-by-industry (IXI) tables from EXIOBASE 3.10.2, a multi-regional input–output (MRIO) database. This method calculates production-chain carbon dioxide (CO_2) emissions and attributes them to demand through direct and indirect input relationships between sectors. Scope 2 emissions associated with electricity purchased by Türkiye's steel sectors have been recalculated using physical electricity consumption data from the Turkish Statistical Institute (TÜİK) and the electricity emission factor published by the Ministry of Energy and Natural Resources (ETKB) (TÜİK, 2024a, 2024b; ETKB, 2024). Using physical electricity consumption data strengthens the assessment of the relationship between steel production and the electricity system, particularly for secondary steel. EXIOBASE accounting has been retained for direct facility emissions (Scope 1) and other upstream supply chain emissions (Scope 3). The revised production footprint has been allocated between domestic final demand and exports using the distribution shares from the original accounting.

The report uses three complementary system boundaries:

- **The production-based approach** identifies the direct emissions associated with basic and secondary steel production in Türkiye, together with emissions arising along upstream energy and input supply chains.
- **The consumption-based approach** identifies emissions associated with domestic and foreign steel production serving Türkiye's final demand.
- **The trade approach** traces how emissions embedded in Türkiye-produced steel are distributed between domestic final demand and foreign markets, and how emissions embedded in foreign steel production are distributed between uses within Türkiye and re-exports.

The results represent production-chain CO_2 footprints calculated from economic flows, rather than physical quantities of steel or emissions intensities per unit of steel. In this report, domestic steel refers to steel produced in Türkiye, while imported steel refers to steel produced in other countries. Imported steel flows are examined from the perspectives of both the source country where the steel is produced and the last supplier country through which it reaches Türkiye. Steel may arrive in Türkiye directly from its country of production or after being processed or incorporated into other products in additional countries. The last supplier country therefore does not always indicate where the steel was produced. Combining these two perspectives reveals the steel production linkages underlying direct trade relationships.

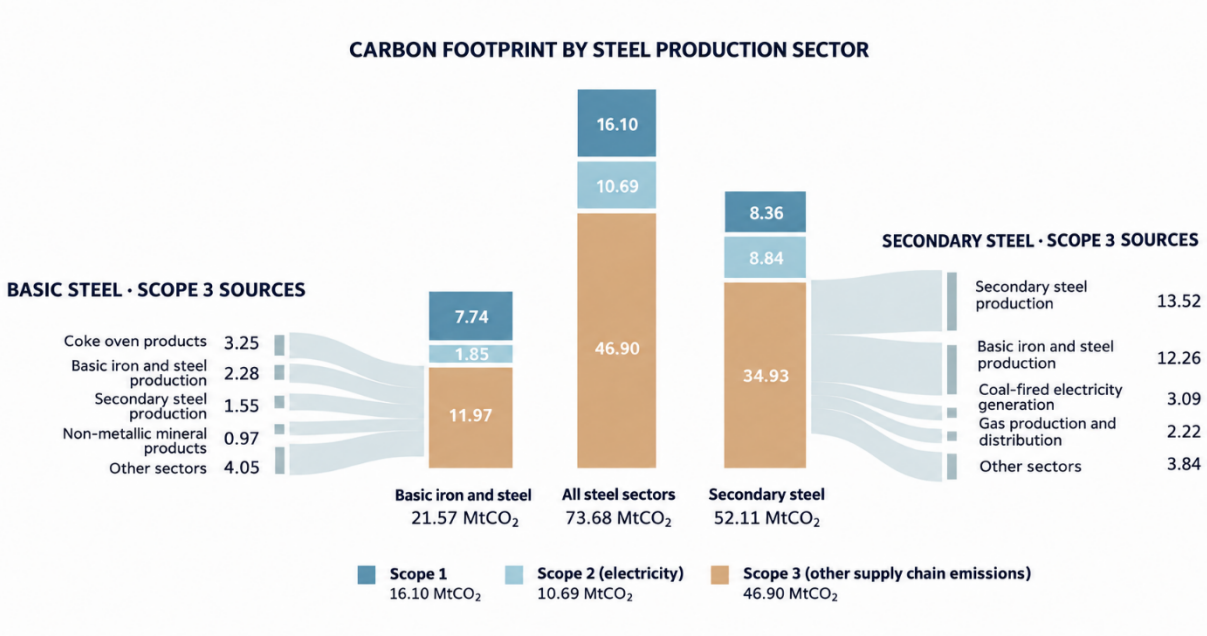
To explain how the asymmetry between production and consumption arises, the report first examines the energy and supply linkages underlying steel production in Türkiye, followed by the demand served by this production. It then considers the domestic and foreign steel production underpinning Türkiye's final demand, before examining the connections between imported steel, production within Türkiye and re-exports. This sequence provides an integrated assessment of the relationships extending from upstream inputs to final use and foreign markets.

WHAT DRIVES THE CARBON FOOTPRINT OF STEEL PRODUCTION IN TÜRKİYE?

Steel produced in Türkiye relies on an extensive network of industrial activities and energy supply extending upstream of steelmaking itself. Examining this network reveals the emissions associated with electricity generation and input production beyond steel facilities' direct operations.

The total production-chain carbon footprint of Türkiye's steel production is 73.7 million tonnes of CO_2 ($MtCO_2$), of which 78% arises outside facilities' direct operations. Direct facility emissions account for 22% of the total, at 16.1 $MtCO_2$. Emissions from purchased electricity amount to 10.7 $MtCO_2$, or 15%, while other upstream supply chain emissions account for 46.9 $MtCO_2$, or 64%. The total footprint is therefore approximately 4.6 times the direct emissions of steel facilities.

Figure 1 — Production-chain carbon footprint of Türkiye's steel sectors, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI and TÜİK data.

The carbon footprints of basic and secondary steel production differ in the relative contributions of direct facility emissions, purchased electricity and upstream supply chains. The total footprint attributed to basic steel is 21.57 $MtCO_2$, compared with 52.11 $MtCO_2$ for secondary steel. Although direct emissions are similar in magnitude across the two production branches, they account for 36% of the basic steel footprint and 16% of the secondary steel footprint. Electricity and other upstream inputs contribute a larger share of secondary steel's footprint. Since total footprints also reflect production volumes, these differences should not be interpreted as a comparison of emissions intensities per unit of output.

The relatively small share of direct emissions in secondary steel's total footprint highlights the importance of electricity and upstream supply chains. Approximately 84% of its total footprint arises outside facilities' direct operations. Assessing the carbon performance of secondary steel therefore requires examining the electricity system and the conditions under which inputs are produced, alongside the facilities themselves.

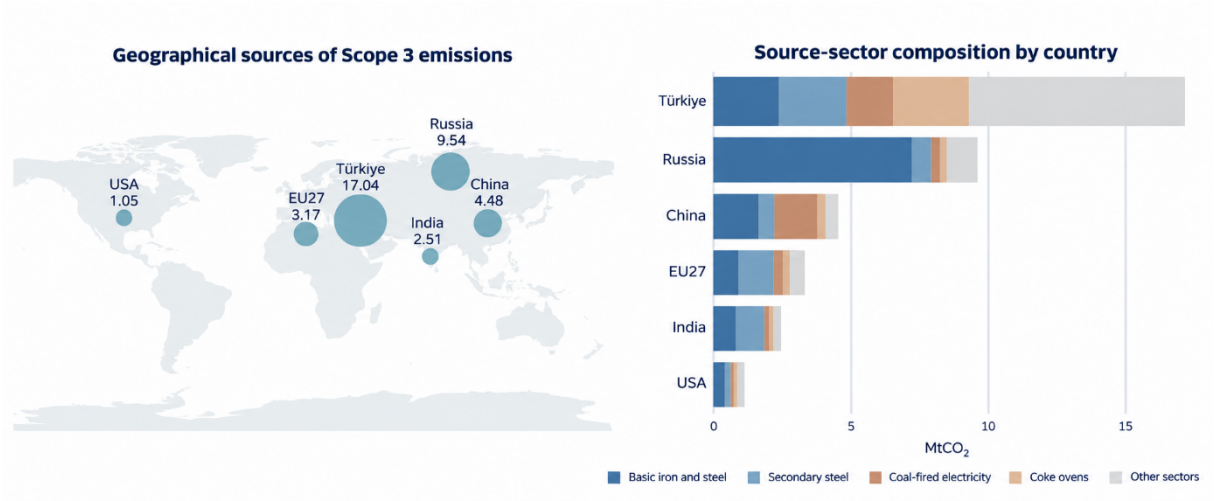
The carbon intensity of the electricity system is particularly important for secondary steel production. Secondary steel accounts for 83% (8.84 $MtCO_2$) of emissions associated with electricity purchased by Türkiye's steel sectors. In secondary steel production, emissions from purchased electricity exceed direct facility emissions. Approximately 97% of the total Scope 2 footprint is associated with fossil fuel-based electricity generation, indicating that the potential emissions advantage of scrap-based production also depends on the carbon intensity of the electricity system.

Upstream supply chains connect steel production in Türkiye to both domestic industrial activities and production conditions abroad. Of total Scope 3 emissions, 36% (17.04 $MtCO_2$) arise in Türkiye and 64% (29.86 $MtCO_2$) in other countries. Domestic supply chain emissions alone exceed the direct emissions of steel facilities.

This demonstrates that the scope for domestic transformation extends beyond steel plants. Domestic sectors supplying energy, materials and other intermediate inputs also have an important role in reducing steel's production-chain footprint.

The international dimension of supply chains is more pronounced in secondary steel. Foreign sources account for 54% of Scope 3 emissions in basic steel and 67% in secondary steel. Secondary steel's dependence on electricity is therefore accompanied by a substantial foreign supply chain footprint, with approximately two-thirds of its upstream emissions originating outside Türkiye.

Figure 2 — Geographical sources of Scope 3 emissions and source-sector composition by country, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

Russia, China and India account for 55.4% of foreign-origin Scope 3 emissions. Earlier stages of basic and secondary steel production generate 46.2% of the total Scope 3 footprint. Electricity generation, coke oven products and natural gas supply are other important sources. This distribution highlights the importance of both earlier metal production stages and the energy systems supporting them.

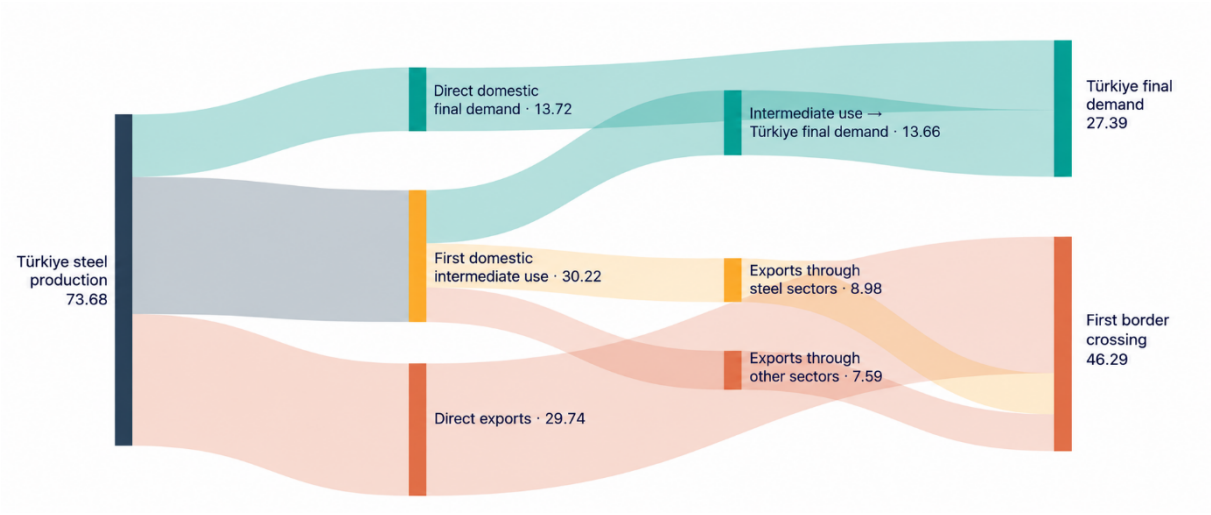
The contribution of electricity extends beyond the electricity purchased by steel facilities. A further 8.25 $MtCO_2$ arises from coal- and natural gas-fired electricity generation along upstream supply chains. Taken together, Scope 2 emissions and emissions from these two Scope 3 electricity sources account for approximately one-quarter of the total production-chain footprint.

The footprint of steel produced in Türkiye reflects both the direct operations of domestic facilities and the conditions under which domestic and imported inputs are produced. Emissions attributed to this production are embedded in steel products and in other products that use steel as an input. Tracing subsequent steel use and its associated embedded emissions reveal which economies' demand is ultimately served by these production chains.

HOW IS THE CARBON FOOTPRINT OF TÜRKİYE-PRODUCED STEEL DISTRIBUTED BETWEEN DOMESTIC AND FOREIGN DEMAND?

Of the emissions embedded in steel produced in Türkiye, 62.8% (46.29 $MtCO_2$) are carried to foreign markets at the first border crossing, while 37.2% (27.39 $MtCO_2$) serve Türkiye's final demand. This distribution includes direct steel exports as well as steel passing through further production stages within Türkiye before being exported. The first border crossing identifies the initial export destination rather than the location of steel's ultimate use.

Figure 3 — Allocation of Türkiye-produced steel between domestic final demand and exports, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

Domestic intermediate production is an important route through which steel serves foreign demand. Of the 30.22 $MtCO_2$ footprint initially entering domestic intermediate use, 54.8% is exported after subsequent production stages. Selling steel first to a producer in Türkiye therefore does not mean that its footprint will remain within domestic final demand. Linkages between the steel sectors themselves dominate initial use, while fabricated metal products, motor vehicles and construction become more prominent at subsequent stages.

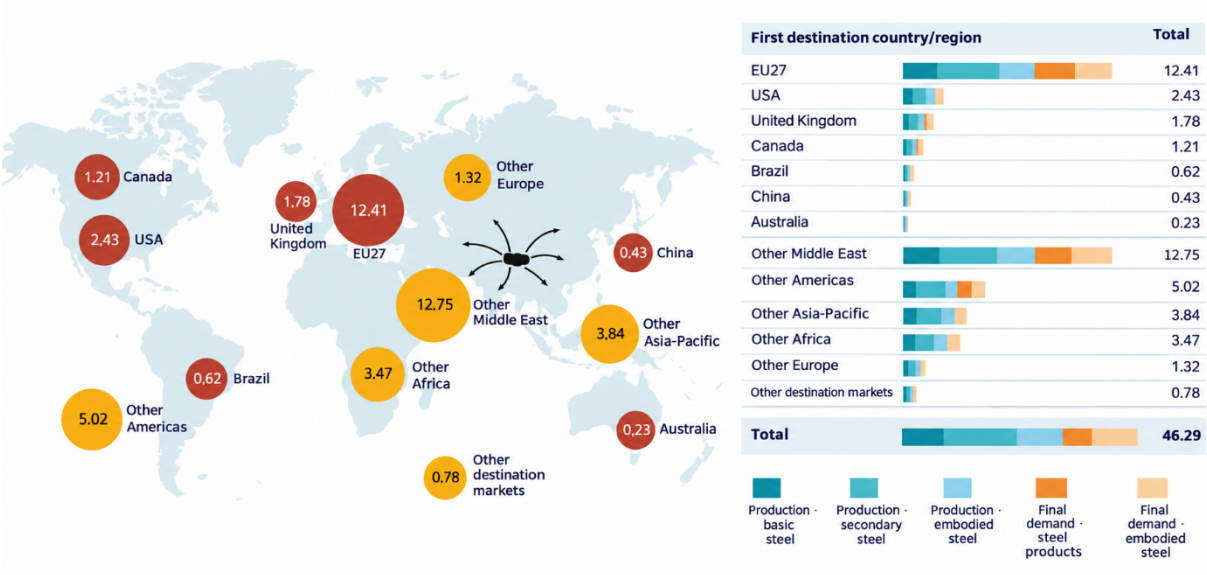
The footprint of domestic steel production retained in Türkiye's final demand is divided approximately equally between direct deliveries to final demand and flows passing through intermediate production stages. However, 74.1% of the total retained domestically is associated with changes in inventories. This national accounts category records the net change in products added to and withdrawn from inventories and does not directly identify physical end uses. The results should therefore be interpreted as an allocation of the footprint across final demand accounts rather than as a measure of steel's physical use.

On the export side, emissions embedded in steel also move beyond direct trade in steel products. **Of the export footprint, 83.6% crosses the border in steel-sector products, while 16.4% is embedded in products exported by other sectors.** Motor vehicles and fabricated metal products account for approximately 80% of the latter channel. These sectors carry the steel-related footprint to foreign markets through their own exports. The carbon performance of steel production is therefore also reflected in the production chains of steel-using manufactured goods.

Most of the footprint exported from Türkiye is associated with products entering further production processes abroad. Of the export footprint, 87.3% initially enters producing sectors in other countries. Construction and fabricated metal products are the principal first recipient sectors. Of the footprint ultimately reaching final demand after production stages abroad, fixed capital formation accounts for 52.3% and household consumption for 35.7%. Steel produced in Türkiye thus supports both investment and the production of consumer goods.

The nature of these relationships varies across markets. The EU Member States (EU27) account for 26.8% of the footprint at the first border crossing, while the other Middle Eastern countries, represented as an aggregated region in EXIOBASE, account for 27.5%. In the other Middle Eastern countries, steel products supplied as intermediate production inputs are particularly prominent. In the EU27, steel embedded in other manufactured products exported by Türkiye also plays an important role.

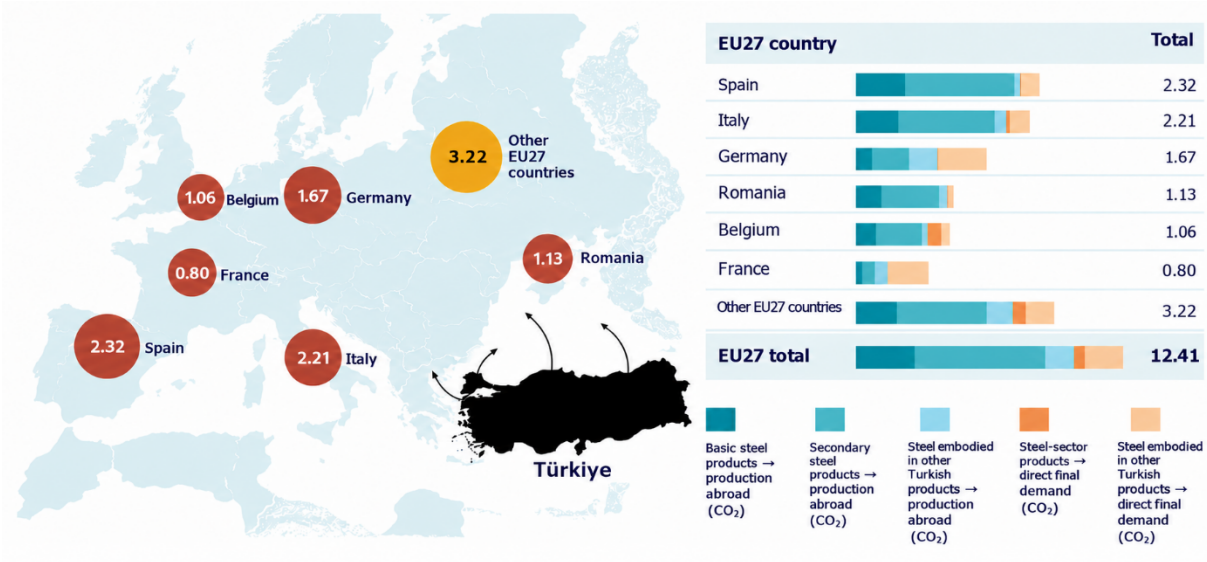
Figure 4 — Footprint of Türkiye-produced steel by first export destination, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

Within the EU27, steel products entering further production account for the largest share of the footprint reaching Spain, Italy and Romania. In Germany and France, exports from Türkiye's steel-using manufacturing sectors play a more prominent role. First export destinations may also differ from the locations of final demand reached after subsequent production and trade stages. The first trading partner, the first recipient sector and the economy where final demand originates therefore reveal different dimensions of Türkiye's position in international steel value chains.

Figure 5 — Principal first export destinations within the EU27 and sectoral linkages, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

These differences across markets also shape which actors need to be involved in efforts to support low-carbon exports. Where steel intermediate inputs predominate, steel producers and industrial users in foreign markets

play a central role. In markets where other manufactured products from Türkiye are more prominent, automotive, machinery and metal products exporters are also part of the transformation. The carbon performance of exports should therefore be assessed with attention to product and value chain linkages.

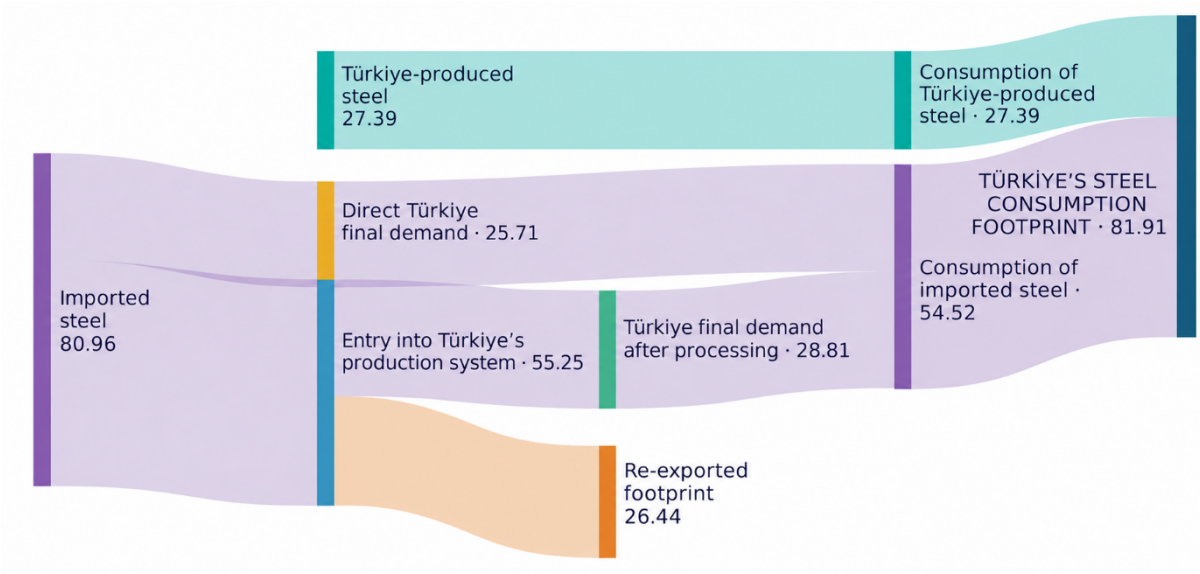
Domestic steel production thus forms part of a network extending from imported inputs through processing activities in Türkiye to foreign markets. However, only 27.39 $MtCO_2$ of the footprint attributed to this production remains within Türkiye's final demand. Understanding Türkiye's total steel consumption footprint therefore requires examining the foreign steel production linkages that complement this domestic component.

HOW DO DOMESTIC AND FOREIGN STEEL PRODUCTION CONTRIBUTE TO TÜRKİYE'S CONSUMPTION FOOTPRINT?

The markets served by steel produced in Türkiye do not, on their own, explain the total carbon footprint of domestic steel use. Türkiye's final demand is linked to both domestic and foreign steel production. Consumption-based accounting brings together emissions arising along the steel production chains serving this demand, regardless of production origin. Türkiye's consumption footprint therefore includes steel-related emissions embedded in imported products and in imported inputs used in domestic production.

Foreign steel production accounts for 66.6% of Türkiye's gross steel consumption footprint of 81.91 $MtCO_2$. The domestic production component amounts to 27.39 $MtCO_2$, or 33.4% of the total, while the component attributed to foreign steel production reaches 54.52 $MtCO_2$. The 27.39 $MtCO_2$ identified in the preceding section as the footprint of domestic steel production serving domestic final demand is therefore one component of the total consumption footprint.

Figure 6 — Türkiye's steel consumption footprint by production origin and pathway to final demand, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

Of the imported steel footprint retained in Türkiye's final demand, 47.2% (25.71 $MtCO_2$) reaches final demand directly, while 52.8% (28.81 $MtCO_2$) reaches it after passing through production processes in Türkiye. The distinction between domestic and imported steel refers to where the steel is produced, rather than to the location of all emissions along its production chain.

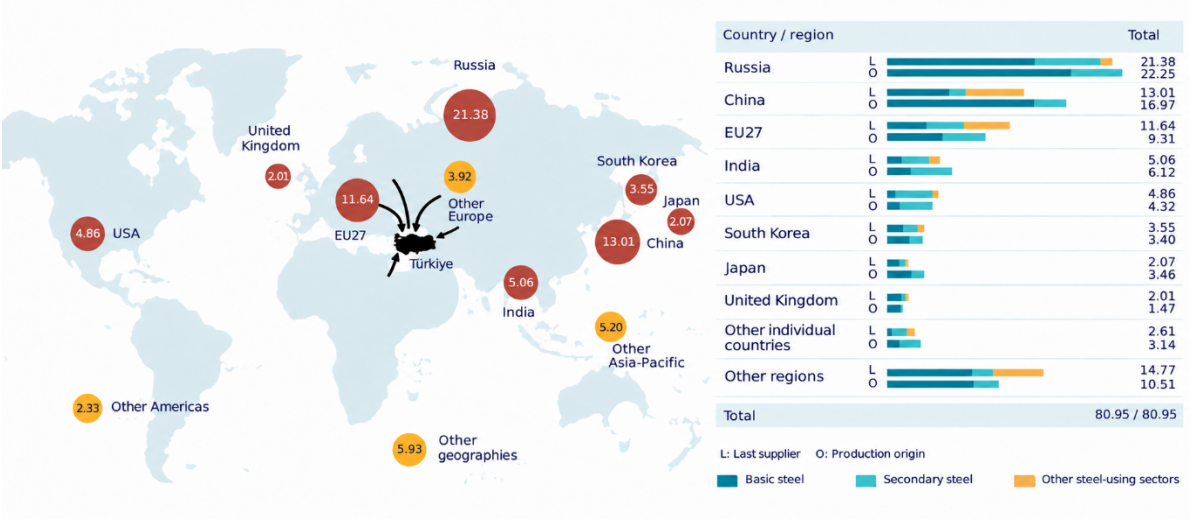
HOW IS THE IMPORTED STEEL FOOTPRINT LINKED TO TÜRKİYE'S PRODUCTION AND EXPORTS?

Approximately one-third of the total 80.96 $MtCO_2$ footprint associated with foreign steel production reaching Türkiye is carried to foreign markets after passing through domestic production processes. **Of the imported steel footprint, 67.3% (54.52 $MtCO_2$) serves Türkiye's final demand, while 32.7% (26.44 $MtCO_2$) is re-exported.** Türkiye therefore acts both as a final consumption market for imported steel and as an intermediate production hub in international value chains.

Of the imported steel footprint, 76.4% (61.89 $MtCO_2$) reaches Türkiye in steel-sector products, while 23.6% (19.07 $MtCO_2$) arrives embedded in products from other sectors. Motor vehicles, electrical machinery and equipment, fabricated metal products and machinery are prominent in the latter channel.

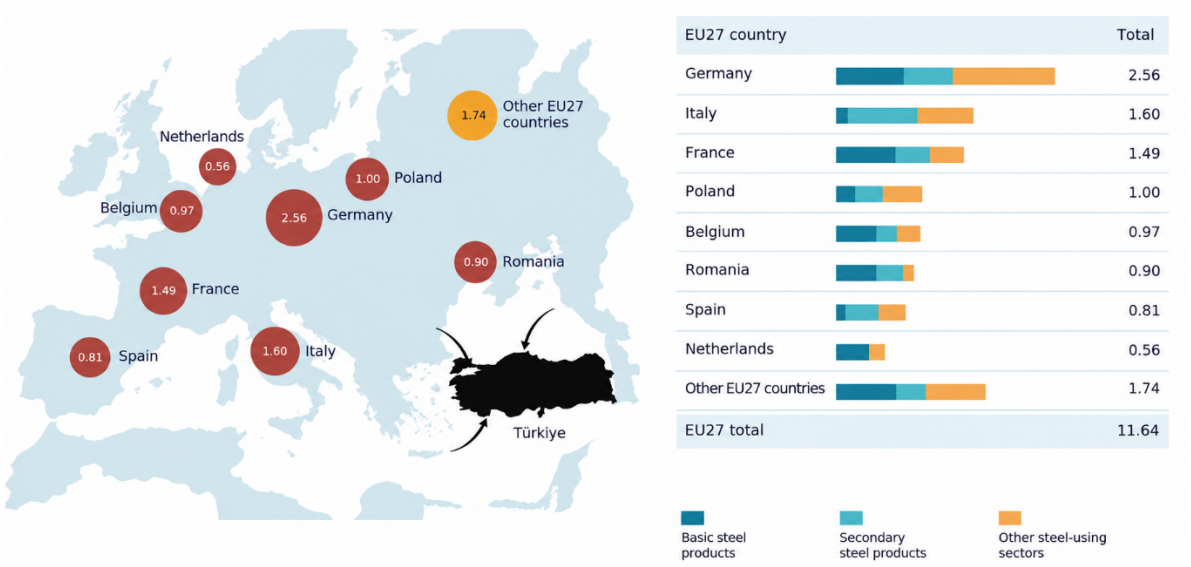
This multi-stage structure is also reflected in geographical linkages. The country where steel is produced is not always the last supplier country through which it reaches Türkiye. Here, production origin refers to the country or region where the steel is produced, while last supplier geography refers to the location of the foreign sector supplying the product that enters Türkiye. Neither necessarily identifies all the locations where emissions arise along the production chain.

Figure 7 — Imported steel linkages by production origin and last supplier geography, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

Figure 8 — Distribution of the EU27 supplier network by country, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

The supplier network for Türkiye's imported steel linkages is concentrated in Russia, China and the EU27. More than half of the total footprint reaches Türkiye through these three economies or regions. However, the products carrying these linkages differ. Steel-sector products dominate the linkages arriving through Russia, while non-steel industrial products also play an important role in those arriving through China and the EU27. Within the EU27, Germany, Italy and France are prominent, with the sectoral composition of last suppliers varying across Member States.

The last supplier geography of a product reaching Türkiye may differ from the production origin of the steel embedded in it. China accounts for 21.0% of the imported steel footprint by production origin, compared with 16.1% by last supplier. For the EU27, the last supplier share of 14.4% exceeds its production-origin share of 11.5%. This pattern shows that steel reaching Türkiye may pass through production stages in different countries and that the last supplier country does not always indicate where the steel was produced. Assessing the carbon footprint of imported inputs therefore requires examining earlier production stages as well as the last supplier.

Imported steel linkages spread across different sectors through domestic production processes. Of the total footprint, 68.2% (55.25 $MtCO_2$) enters intermediate use by producing sectors. Secondary steel and fabricated metal products are the principal first recipient sectors. The linkage between foreign basic steel production and Türkiye's secondary steel sector highlights the importance of earlier steel production stages for secondary steel's carbon footprint. Non-steel sectors collectively account for approximately 56% of the footprint at its first entry into domestic production. Construction, automotive manufacturing and other activities become more prominent at subsequent stages. The uses served by imported steel linkages thus extend beyond the first recipient sectors.

Approximately half of the imported steel footprint entering Türkiye's production system is subsequently re-exported. Of the 55.25 $MtCO_2$ entering production, 52.1% serves domestic final demand and 47.9% is carried to foreign markets. Approximately 49% of the export-bound footprint crosses the border in steel products, while more than half is embedded in products from other sectors. Secondary steel, fabricated metal products and motor vehicles are the principal exporting sectors carrying this footprint.

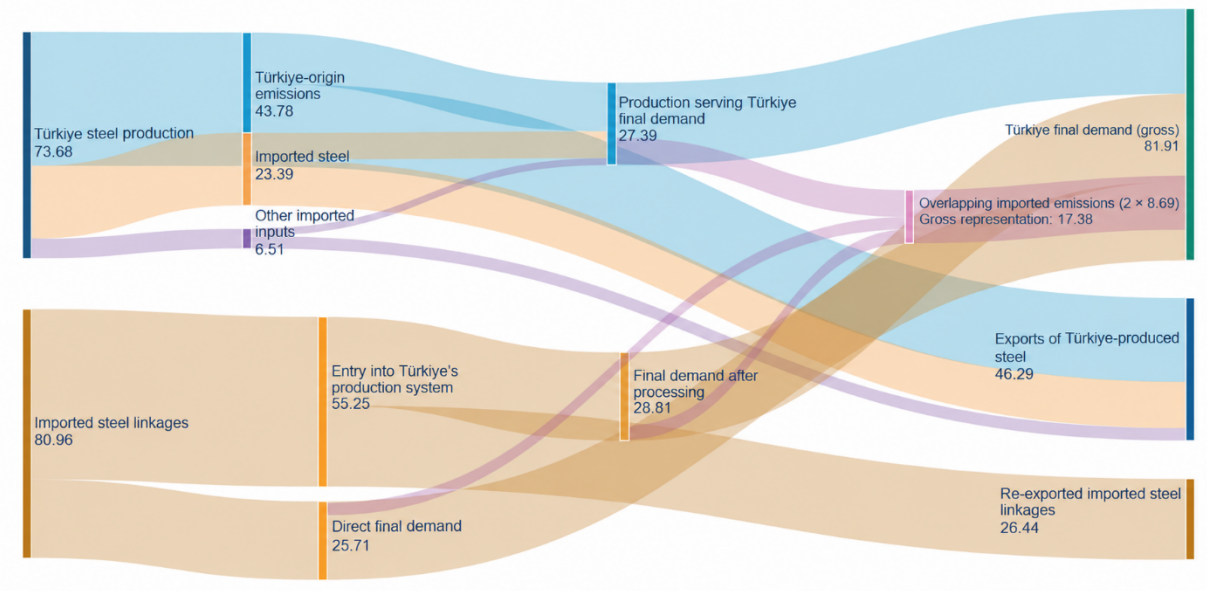
Approximately 73% of the re-exported footprint initially enters producing sectors in other countries, while 27% reaches final demand directly. Through its domestic industry, Türkiye connects steel production originating in different countries to production and demand in other economies. Producers' and exporters' sourcing decisions therefore affect embedded emissions serving both domestic uses and foreign markets.

Distinguishing the domestically retained and re-exported components of imported steel linkages is necessary for understanding the net trade balance in embedded carbon. Treating the entire gross imported footprint as Türkiye's consumption would obscure this intermediate production role.

WHAT DO THE ASYMMETRY BETWEEN PRODUCTION AND CONSUMPTION AND THE NET TRADE BALANCE IN EMBEDDED CARBON REVEAL?

Türkiye's net steel-related consumption footprint is 67% higher than its domestically generated production-chain emissions, while import-related emissions exceed export-bound emissions by 64%. Türkiye is a net importer of approximately 30 $MtCO_2$ of steel-related embedded carbon. Emissions associated with domestic and imported steel linkages serving domestic final demand total approximately 82 $MtCO_2$ on a gross basis. After overlapping emissions are counted only once, the net final demand footprint is approximately 73 $MtCO_2$. Domestically generated production-chain emissions amount to approximately 44 $MtCO_2$. Following adjustments for re-exports and overlapping emissions, import-related emissions amount to approximately 76 $MtCO_2$, compared with approximately 46 $MtCO_2$ of export-bound production-chain emissions. Both accounting approaches identify Türkiye as a net importer of embedded emissions.

Figure 9 — Integrated accounting of Türkiye's steel-related production, consumption and trade emissions, 2022 ($MtCO_2$)



Source: Authors' calculations using EXIOBASE 3.10.2 IXI.

This asymmetry reveals Türkiye's three distinct roles in steel value chains as a producer, user and intermediary of embedded carbon. Türkiye generates substantial emissions associated with steel production and directs a large share of that production towards foreign markets. At the same time, the carbon footprint of domestic final demand exceeds domestically generated production-chain emissions and depends heavily on foreign steel production. Türkiye's export-oriented production structure therefore does not imply that it is a net exporter of embedded carbon.

Türkiye is also an intermediate production hub through which imported embedded emissions reach foreign markets. Of the approximately 30 $MtCO_2$ of foreign-origin emissions in its steel production chain, 63% (approximately 19 $MtCO_2$) is associated with exports. In addition, approximately 26 $MtCO_2$ of the imported steel footprint is re-exported after passing through Türkiye's production system. These flows show that Türkiye connects emissions generated both domestically and abroad to international demand.

Secondary steel production is one of the principal production branches where these relationships intersect. Its strong links to electricity consumption and foreign supply chains are accompanied by its prominent role in exports. Secondary steel is also among the main first recipient sectors for imported steel linkages and plays an important role in their subsequent re-export. Decarbonising secondary steel therefore requires attention to direct facility emissions and electricity use, as well as the carbon intensity of imported inputs and the total footprint of products supplied to foreign markets.

Assessing production, consumption and trade together reveals Türkiye's position in steel value chains through its production and export performance, its dependence on global supply chains and its intermediary role in international trade in embedded carbon. This integrated approach highlights the importance of addressing the connections between domestic production, imported inputs and final demand when decarbonising the steel sectors.

WHAT ARE THE PRIORITIES FOR DECARBONISING TÜRKİYE'S STEEL VALUE CHAINS?

Decarbonising Türkiye's steel value chains requires a transformation extending from production facilities to energy supply, input sourcing, steel-using sectors and final demand. The export orientation of domestic production, the strong links between domestic demand and foreign steel production, and the re-export of imported steel after processing in Türkiye demonstrate that these areas are interconnected. A strategy for transforming the steel sectors should therefore support both low-carbon production and an industrial structure that uses low-carbon inputs in products supplied to international production chains.

- **Transformation at steel facilities should reflect the different emissions and supply profiles of basic and secondary steel production.** Reducing direct process and fuel-related emissions is important in basic steel production. In secondary steel, electricity consumption and the carbon performance of upstream inputs are particularly important alongside facility efficiency. Process improvements, energy and material efficiency, equipment upgrades and low-carbon production options should be assessed in light of each facility's technical characteristics. This study identifies where emissions linkages are concentrated. Prioritising technologies and investment options, however, requires facility-level technical and economic analysis.

- **Decarbonising electricity supply and ensuring industrial access to low-carbon electricity are central to the transformation of steel value chains.** Electricity generation emissions contribute to steel's footprint through both the electricity purchased by facilities and the production of raw materials and intermediate inputs. The importance of electricity consumption in secondary steel, in particular, ties its low-carbon production potential to the transformation of the electricity system. Renewable electricity generation, grid investment and reliable industrial access to low-carbon electricity can support the transformation of both steel facilities and domestic suppliers.

- **Low-carbon sourcing policies should cover both domestic and imported inputs.** The scale of upstream emissions within Türkiye makes the transformation of domestic energy and intermediate input suppliers an important component of steel policy. For imported inputs, supplier selection, purchasing criteria and information on production conditions are also important. The strong links between secondary steel production and international supply chains call for an assessment of earlier production and processing stages associated with scrap and other metal inputs. Improving scrap collection, sorting and preparation, together with monitoring the carbon performance of inputs, could provide complementary measures.

- **Differences between steel's production origin and its last supplier country require carbon information and traceability to extend beyond the direct supplier.** Verifiable facility- and product-level emissions data, together with supplier information on earlier production stages, can support purchasing and investment decisions. MRIO analysis does not identify the routes taken by individual products or shipments. It does, however, indicate which production linkages warrant more detailed information and closer cooperation with suppliers.

- **Steel-using sectors shape demand for low-carbon steel.** Material choices and production and sourcing decisions in automotive manufacturing, machinery, fabricated metal products and construction influence how steel is used and which markets it serves. Steel producers' investment plans can be considered alongside these sectors' technical requirements and sourcing plans. Common material criteria, public procurement and long-term purchasing commitments can create more predictable demand for low-carbon steel. Longer product lifetimes, reuse and material efficiency can also help deliver the same function with less newly produced steel.

- **Policy priorities should reflect both the scale of emissions linkages and the capacity to intervene.** Domestic regulation and investment can influence facilities and the electricity system within Türkiye more directly, while production processes in other countries fall outside Türkiye's direct regulatory jurisdiction. Nevertheless, supplier selection, purchasing standards, long-term commercial relationships and international cooperation offer opportunities for indirect influence. A linkage with a large footprint does not necessarily offer the greatest emissions reduction potential or the lowest

intervention cost. Prioritisation should therefore consider technical options, costs and institutional mandates together.

- **Emissions covered by the ETS and CBAM should be considered alongside the broader carbon linkages of steel value chains.** The ETS focuses on emissions generated at covered domestic facilities, while CBAM addresses the embedded emissions of specified products imported into the EU within defined production boundaries. Steel's linkages, extending from electricity and input supply to its use in other sectors, reach beyond these regulatory scopes. Carbon pricing should therefore be complemented by policies supporting low-carbon electricity, low-carbon sourcing and demand for low-carbon steel in user sectors. This would support emissions reductions both within regulated activities and elsewhere in the steel value chain.

Policy success should be monitored through changes in production-chain emissions, consumption footprints and emissions embodied in trade, alongside direct facility emissions. Approximately 78% of the footprint of Türkiye's steel production arises outside facilities' direct operations, making it necessary to track developments in electricity and supply chains as well. With approximately 63% of the domestic steel production footprint associated with exports and approximately 67% of the consumption footprint linked to foreign steel production, improvements in domestic production need to be assessed alongside consumption and trade indicators. The processing and re-export of imported steel in Türkiye also show that changes in sourcing can affect embodied emissions serving both domestic uses and foreign markets. Combining facility- and product-level data with energy, foreign trade and MRIO indicators would make it possible to monitor policy effects across these linkages and distinguish overall emissions reductions from shifts in emissions between countries or sectors.

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