POLICY BRIEF

# ELECTRIFICATION:
## NECESSARY BUT NOT SUFFICIENT

Why Türkiye Must Decarbonise Electricity to Transform Industry, Reduce Emissions and Support Lower-Carbon Trade

November 2026 • sefia.org

SEFiA is a research-oriented civil society organisation established to conduct independent studies on sustainable economics and sustainable finance, with a particular focus on Türkiye's transition to a low-carbon economy and the fight against climate change. Aiming to develop data, knowledge and research capacity through national and international collaborations, SEFiA seeks to contribute to low-carbon economic policies.

## AUTHOR

Ayşe Ceren Sarı, Research Director
m: ayse@sefia.org

**Publication Date:** November 2026
**Design:** T. Algüz Duransoy & Civic Space Media

/sefiaorg

# Contents



EXECUTIVE SUMMARY 04

1. ELECTRIFICATION CAN REDUCE FOSSIL-FUEL DEPENDENCE, BUT ELECTRICITY MUST BECOME CLEANER 06

3. INDUSTRIAL ELECTRICITY USE: CLEAN POWER IS ESSENTIAL, AND SECTORAL PATHWAYS DIFFER 09

4. ELECTRICITY-RELATED EMISSIONS TRAVEL THROUGH DOMESTIC PRODUCTION CHAINS 11

5. ELECTRIFICATION ALONE IS NOT ENOUGH TO DECARBONISE TÜRKIYE'S EXPORTS 12

6. TÜRKIYE'S IMPORTS CARRY EMISSIONS FROM ELECTRICITY GENERATION ABROAD 14

7. CARBON PRICING AND TRADE POLICY MUST SUPPORT THE ELECTRICITY TRANSITION 15

8. COP31: ELECTRIFICATION COMMITMENTS MUST DELIVER REAL EMISSIONS REDUCTIONS 16

9. EIGHT PRIORITIES FOR A CREDIBLE COP31 ELECTRIFICATION AGENDA 17

DATA SOURCES AND METHODOLOGY 20

References and source material 22

# EXECUTIVE SUMMARY

Electrification is becoming a central priority in global climate policy. As Türkiye prepares to host COP31, its proposed 35-by-35 Global Electrification Pledge aims to increase electricity's share of global final energy consumption to 35% by 2035 (COP31 Presidency, 2026). Replacing fossil-fuel-based technologies with efficient electric alternatives can reduce energy requirements, lower direct emissions and decrease fossil-fuel dependence across transport, buildings and industry (IEA, 2026).

Electrification can contribute to the energy transition by replacing direct fossil-fuel use with electricity and improving the efficiency of energy services. Its contribution to climate goals depends on the efficiency of the technologies adopted, the fossil fuels displaced and the carbon intensity of electricity generation. Electrification alone does not guarantee deep emissions reductions. Decarbonising electricity reduces emissions associated with existing electricity consumption while strengthening the benefits of further electrification.

**This brief asks what Türkiye's existing production and emissions structure means for the COP31 electrification agenda.** It examines the contribution of electricity generation to production-based carbon dioxide ($CO_2$) emissions, the electricity-related footprint of manufacturing and other users, and the connections between electricity-generation emissions and international trade. These findings provide a basis for assessing how electrification commitments should be linked to electricity-sector decarbonisation, industrial transformation, trade competitiveness and climate goals. The analysis describes existing emissions relationships to inform policy priorities, rather than estimating the future emissions-reduction potential of electrification.

Sustainable Economics and Finance Association's (SEFiA) analysis identifies four findings:

**01** **Electricity generation is a major source of Türkiye's emissions.** Electricity generation produced an estimated **144 million tonnes $CO_2$ (Mt $CO_2$) in 2022**, accounting for **35%** of production-based $CO_2$ emissions from economic activities. Coal-fired electricity generation alone accounted for an estimated **114 Mt $CO_2$**, equivalent to around **28%** of emissions from economic activities.

**02** **Electricity-related emissions extend throughout the economy.** Manufacturing electricity consumption was associated with approximately **54 Mt $CO_2$ in 2022**, accounting for **46% of electricity-related emissions associated with economic activities**. Iron and steel accounted for around 20% (**11 Mt $CO_2$**) of manufacturing's electricity-related emissions, of which around **9 Mt $CO_2$** was associated with secondary steel production. Textiles, food processing and cement also had substantial electricity-related emissions. Cleaner electricity can reduce these existing footprints, while further electrification can replace fossil-fuel use in processes where electric alternatives are technically viable.

**03** **Electricity-generation emissions are embedded in Türkiye's exports.** Coal- and gas-fired electricity accounted for nearly **one-fifth** of domestically generated $CO_2$ embodied in Türkiye's gross exports in 2022, equivalent to approximately **25 Mt $CO_2$**. Electricity-sector decarbonisation can therefore support lower-carbon exports through both exporters' electricity use and the domestic inputs they purchase.

**04** **Türkiye's final demand is also connected to electricity generated abroad.** Coal-fired electricity used abroad to produce goods and services ultimately serving Türkiye's final demand generated around **31 Mt $CO_2$ in 2022**. These emissions, embedded in imported products and their supply chains, accounted for around **20%** of foreign-origin $CO_2$ associated with Türkiye's final demand.

**113.5 Mt $CO_2$**

Emissions from coal-fired electricity generation in Türkiye in 2022, representing **27.6%** of production-based $CO_2$ emissions from economic activities.

**54.3 Mt $CO_2$**

Estimated electricity-related emissions associated with manufacturing electricity consumption in 2022.

**17.8 Mt $CO_2$**

Domestic coal-fired electricity emissions embodied in Türkiye's gross exports in 2022, accounting for **13.3%** of domestic-origin export $CO_2$.

**31.3 Mt $CO_2$**

Emissions from coal-fired electricity used abroad to produce imported products serving Türkiye's final demand in 2022, accounting for **20.2%** of foreign-origin $CO_2$ associated with that demand.

Together, these findings show that electricity-sector decarbonisation can reduce Türkiye's existing production and consumption footprints, with benefits extending through domestic supply chains to exports. Further electrification can replace fossil-fuel use in processes where electric alternatives are technically viable, while its emissions benefits depend on technological efficiency and the carbon intensity of electricity supply. Emissions embedded in imports also highlight the importance of electricity-sector decarbonisation across international production networks.

With coal-fired electricity generation accounting for roughly 28% of production-based $CO_2$ emissions from economic activities, a planned coal phase-out should be central to Türkiye's electrification agenda. This requires the adoption of a clear timetable for ending coal-fired generation, supported by renewable electricity expansion and improvements in energy efficiency.

For COP31, electrification commitments should translate into implementation programmes that deliver measurable reductions in fossil-fuel use and emissions in line with climate goals. In Türkiye, investment in renewable generation, grids, storage, efficient electric technologies and industrial decarbonisation should support this coal phase-out pathway. Affordable access to clean electricity and a just transition for affected workers and communities must guide implementation.

# 1. ELECTRIFICATION CAN REDUCE FOSSIL-FUEL DEPENDENCE, BUT ELECTRICITY MUST BECOME CLEANER

Electrification can reduce fossil-fuel consumption by replacing combustion-based technologies with more efficient electric alternatives. According to the International Energy Agency (IEA), electric vehicles convert approximately **85–90% of their energy input into useful motion, compared with 25–35% for internal combustion engine vehicles**, while heat pumps typically deliver **three to five units of heat for each unit of electricity consumed**. In industry, electric technologies can replace fossil-fuel combustion in suitable production processes, although opportunities vary across sectors (IEA, 2026).

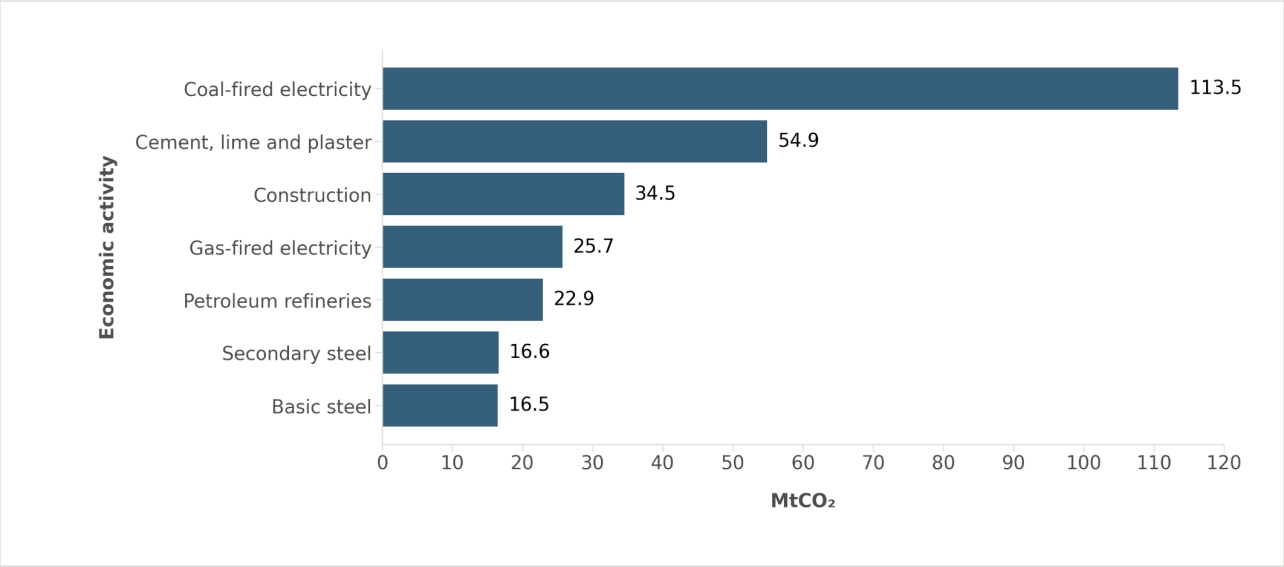
These efficiency gains can deliver emissions reductions even when electricity is partly generated from fossil fuels. However, the scale of the benefits depends on the technologies being replaced and the carbon intensity of electricity supply. As electricity generation becomes cleaner, the same electric technologies can achieve greater emissions reductions.

Türkiye's transport sector already demonstrates growing uptake of electric technologies. Electric car sales reached approximately **240,000 in 2025**, exceeding **20% of new passenger car sales**. The IEA also reports national ambitions to reach **2.5 million electric vehicles on the road and a 35% share of new car sales by 2030**. These developments underline the importance of reducing electricity-generation emissions as electric mobility expands (IEA, 2026).

*The carbon intensity of electricity supply is particularly important for Türkiye, where fossil-fuel power generation remains a major source of $CO_2$ emissions.*

SEFiA's analysis estimates that electricity generation produced approximately **143.8 Mt $CO_2$ in 2022**, accounting for **34.9%** of production-based $CO_2$ emissions from economic activities. Coal-fired electricity generation alone is estimated to have contributed approximately **114 Mt $CO_2$**, equivalent to **27.6%** of emissions from economic activities. Gas-fired electricity generation contributed a further **25.7 Mt $CO_2$**.

**Figure 1. Major sources of production-based $CO_2$ emissions in Türkiye, 2022, Mt $CO_2$**




*Source: SEFiA calculations using EXIOBASE 3.10.2 (2022) and Ministry of Energy and Natural Resources' (MoENR) 2022 electricity-generation emissions factor (MoENR, 2024). The revised electricity-generation total is allocated across generation sources in proportion to their original EXIOBASE emission shares. Emissions are attributed to the activities where they originate.*

The concentration of emissions in coal-fired generation provides a strong basis for prioritising a planned coal phase-out within Türkiye's energy transition. Linking electrification commitments to renewable electricity expansion and declining coal-fired generation would address a major existing emissions source while strengthening the climate benefits of electric technologies.

Electricity is used across manufacturing, transport, commercial activities, public services and households. Consequently, emissions generated by fossil-fuel power plants are connected to the production and consumption activities that electricity supports.

A strategy that expands electricity use without establishing a pathway to phase out fossil fuels risks limiting the climate benefits of electrification. Conversely, phasing out coal-fired generation and expanding renewable electricity can reduce emissions associated with existing electricity consumption while strengthening the benefits of further electrification.

These findings establish why electricity generation is a major area for emissions reduction in Türkiye. Understanding its wider significance for the electrification agenda also requires examining where electricity is used. The distribution of existing electricity consumption shows which economic activities are affected by the carbon intensity of generation and where cleaner electricity can reduce footprints before additional processes are electrified.

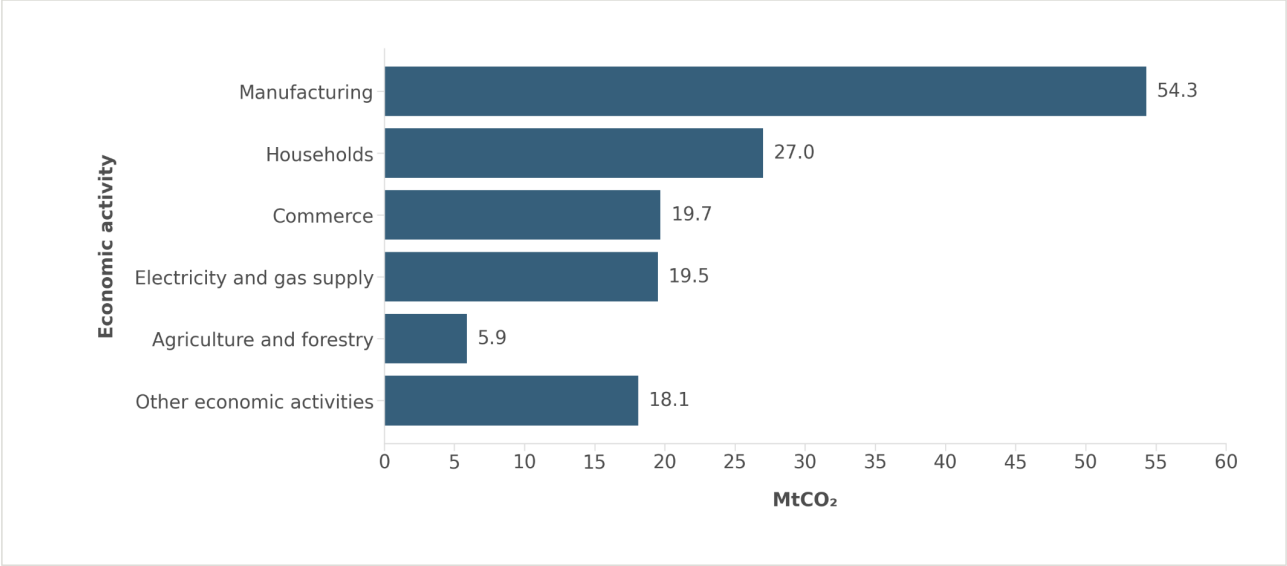
Üretim bazlı emisyon muhasebesi, emisyonların hangi faaliyetlerde ortaya çıktığını göstermektedir. Elektrik sektöründe emisyonlar, fosil yakıtların yakıldığı santrallere kaydedilmektedir. Ancak bu yaklaşım tek başına elektrik üretiminden kaynaklanan emisyonların elektriği kullanan faaliyetlerle bağlantısını göstermemektedir.

SEFiA bu bağlantıları incelemek için Türkiye İstatistik Kurumu'nun (TÜİK) fiziksel elektrik tüketim istatistiklerini, Enerji ve Tabii Kaynaklar Bakanlığı'nın (ETKB) 2022 yılı için hesapladığı **438 g $CO_2$/kWh** düzeyindeki ortalama elektrik üretimi emisyon faktörüyle birlikte kullanmaktadır (ETKB, 2024).

Bu faktörün elektrik tüketimine uygulanmasıyla toplam **144,5 Mt $CO_2$** emisyon hesaplanmıştır. Bu emisyonların **%81,3'ü (117,5 Mt $CO_2$) ekonomik faaliyetlerin**, **%18,7'si (27,0 Mt $CO_2$) ise hanelerin** elektrik tüketimiyle ilişkilidir.

İmalat sanayi, ekonomik faaliyetler arasında elektrik tüketimiyle ilişkili karbon ayak izinin en yüksek olduğu faaliyet grubudur. **2022 yılında yaklaşık 54,3 Mt $CO_2$** olarak hesaplanan bu miktar, **ekonomik faaliyetlerin elektrik kaynaklı emisyonlarının %46,2'sini** oluşturmaktadır.

**Figure 2. Estimated $CO_2$ associated with electricity consumption, 2022, Mt $CO_2$**




*Source: SEFiA calculations using TÜİK physical electricity consumption statistics for 2022 and 2023 and MoENR's 2022 average electricity-generation emissions factor (MoENR, 2024).*

*Note: These estimates describe emissions from the perspective of electricity users and should not be added to emissions attributed to power generation. Differences in statistical coverage and accounting boundaries mean that the consumption-based estimates and the generation total do not form a fully reconciled electricity balance.*

These findings demonstrate why electricity-sector decarbonisation matters across the economy. Cleaner electricity reduces emissions associated with existing manufacturing processes, commercial activities, public services and household electricity use, even if electricity consumption and the equipment used remain unchanged.

However, a sector's current electricity-related carbon footprint is not the same as its potential for further electrification. Existing electricity consumption indicates how strongly a sector is affected by the carbon intensity of generation. Additional electrification potential depends on the fossil-fuel uses that can be replaced, the availability of suitable technologies and their relative efficiency.

Energy efficiency provides a further opportunity to reduce emissions by lowering the electricity and fuel required for production and consumption. It can also limit additional electricity demand as electrification expands.

For Türkiye's electrification agenda, these results distinguish two related tasks: reducing emissions associated with electricity already consumed and replacing suitable direct fossil-fuel uses with efficient electric technologies. Manufacturing's large electricity-related footprint makes this distinction particularly important for industrial policy. The balance between these tasks depends on each industry's existing production structure, energy requirements and emissions sources.

# 3. INDUSTRIAL ELECTRICITY USE: CLEAN POWER IS ESSENTIAL, AND SECTORAL PATHWAYS DIFFER

Manufacturing accounts for the largest electricity-related carbon footprint among Türkiye's economic activities. Electricity powers industrial processes ranging from electric furnaces and production machinery to refrigeration, pumping and compression. Cleaner electricity can therefore reduce emissions across manufacturing without requiring immediate changes in existing production technologies.

Detailed TÜİK data show substantial differences in electricity consumption across manufacturing industries. Iron and steel stands out as the largest electricity consumer among the industries examined, followed by textiles, food processing, cement, rubber and plastics, and chemicals.

**Table 1. Electricity consumption and estimated electricity-related $CO_2$ emissions in selected manufacturing industries, 2022**

| Manufacturing industry | Estimated electricity consumption (TWh) | Estimated electricity-related emissions (Mt $CO_2$) |
|---|---|---|
| **Iron and steel** | 24.40 | 10.69 |
| **Textiles** | 15.38 | 6.74 |
| **Food products** | 11.81 | 5.17 |
| **Cement, lime and plaster** | 9.22 | 4.04 |
| **Rubber and plastics** | 8.53 | 3.74 |
| **Chemicals** | 8.10 | 3.55 |

*Source: SEFiA calculations using TÜİK's 2023 sectoral electricity consumption distribution scaled to 2022 activity totals and MoENR's 2022 average electricity-generation emissions factor of 0.438 t $CO_2$/MWh (TÜİK, 2022, 2023; MoENR, 2024).*

These figures show that electricity decarbonisation can reduce emissions across industries with very different production technologies. However, opportunities for further electrification vary considerably.

## Iron and steel

Türkiye's steel industry is dominated by electric arc furnace (EAF) production, which uses electricity to melt scrap steel (MoIT, n.d.; IEA, 2020). Iron and steel is the largest electricity-consuming manufacturing industry in Türkiye, with estimated electricity consumption of 24.4 TWh in 2022, associated with approximately 10.7 Mt $CO_2$. Of this electricity-related footprint, **8.84 Mt $CO_2$ is allocated to secondary steel production and 1.85 Mt $CO_2$ to basic iron and steel production**. This highlights the importance of cleaner electricity within Türkiye's existing steel production structure.

However, the sector's decarbonisation needs extend beyond electricity supply. Türkiye's steel industry relies heavily on imported scrap and other intermediate inputs, while primary steel production and fossil-fuel use also contribute to its carbon footprint. Further reductions require improvements in material efficiency, lower-carbon

inputs and changes in production technologies. These may include green hydrogen-based direct reduced iron (DRI) combined with EAF production, which could reduce reliance on coal-based primary steelmaking while creating additional demand for clean electricity and green hydrogen (IEA, 2020).

Türkiye's steel transition therefore involves both reducing the carbon intensity of electricity already consumed and developing lower-emission production routes that address remaining direct and supply-chain emissions.

## Cement and chemicals

Türkiye's cement industry is both electricity-intensive and a major source of direct industrial $CO_2$ emissions. Cement, lime and plaster manufacturing consumed an estimated **9.22 TWh of electricity in 2022**, associated with approximately **4.04 Mt $CO_2$**. Electricity is widely used for grinding, crushing and other production equipment. However, much of cement's carbon footprint originates in clinker production, where fossil fuels generate high-temperature heat and $CO_2$ is released during limestone calcination (IPCC, 2022).

These emissions cannot be eliminated through cleaner electricity alone. Further decarbonisation requires improved energy efficiency, lower-carbon fuels, a lower clinker-to-cement ratio and technologies addressing remaining process emissions. Electrification of suitable thermal processes may also contribute, depending on technological developments and the availability of affordable clean electricity (IPCC, 2022).

Türkiye's chemical industry presents a different challenge. Chemical manufacturing consumed an estimated **8.10 TWh of electricity in 2022**, associated with approximately **3.55 Mt $CO_2$**. Its activities range from electricity-intensive processes to those relying heavily on fossil fuels for heat and feedstocks. Cleaner electricity and further electrification can reduce emissions from suitable processes, but deeper decarbonisation also requires changes in feedstocks, production technologies and industrial heat supply (IPCC, 2022).

## Textiles and food processing

Textiles and food processing are among Türkiye's largest industrial electricity consumers, demonstrating the importance of electricity decarbonisation beyond heavy industry.

Türkiye's textile industry consumed an estimated **15.38 TWh of electricity in 2022**, associated with approximately **6.74 Mt $CO_2$**. The industry combines electricity-intensive spinning, weaving and manufacturing processes with substantial thermal energy demand, particularly for dyeing, washing and finishing. Cleaner electricity reduces emissions associated with existing machinery, while electric boilers, heat pumps and other electric heating technologies offer opportunities to replace fossil fuels in suitable processes (IEA, 2026). Given the sector's integration into international textile and apparel supply chains, these improvements can also reduce emissions associated with exports.

Food processing consumed an estimated **11.81 TWh of electricity in 2022**, associated with approximately **5.17 Mt $CO_2$**. Electricity powers refrigeration, motors, pumping and processing equipment, while fossil fuels supply heat for processes such as drying, cooking and pasteurisation. Energy efficiency and cleaner electricity can reduce emissions from existing operations, while electrification of suitable heating processes can further lower fossil-fuel consumption (IEA, 2026).

Both industries illustrate how cleaner electricity can reduce existing emissions while further electrification offers additional opportunities to replace fossil fuels.

## Implications for industrial decarbonisation

Industrial electrification cannot follow a single technological pathway. Cleaner electricity can reduce emissions associated with existing electricity consumption across manufacturing, but opportunities for further electrification depend on sector-specific processes and energy requirements.

For Türkiye, iron and steel can benefit substantially from cleaner electricity within its existing EAF-based production structure, while new production routes may create additional demand for clean energy. In textiles and food processing, electrification offers opportunities to replace fossil-fuel-based heating. In cement and chemicals, deeper emissions reductions also require measures addressing high-temperature heat, process emissions and feedstocks.

Sectoral roadmaps should identify these different needs and coordinate them with energy efficiency, renewable electricity deployment and a planned coal phase-out. The implications extend beyond individual industries because electricity is also used to produce the inputs supplied throughout the economy.

## 4. ELECTRICITY-RELATED EMISSIONS TRAVEL THROUGH DOMESTIC PRODUCTION CHAINS

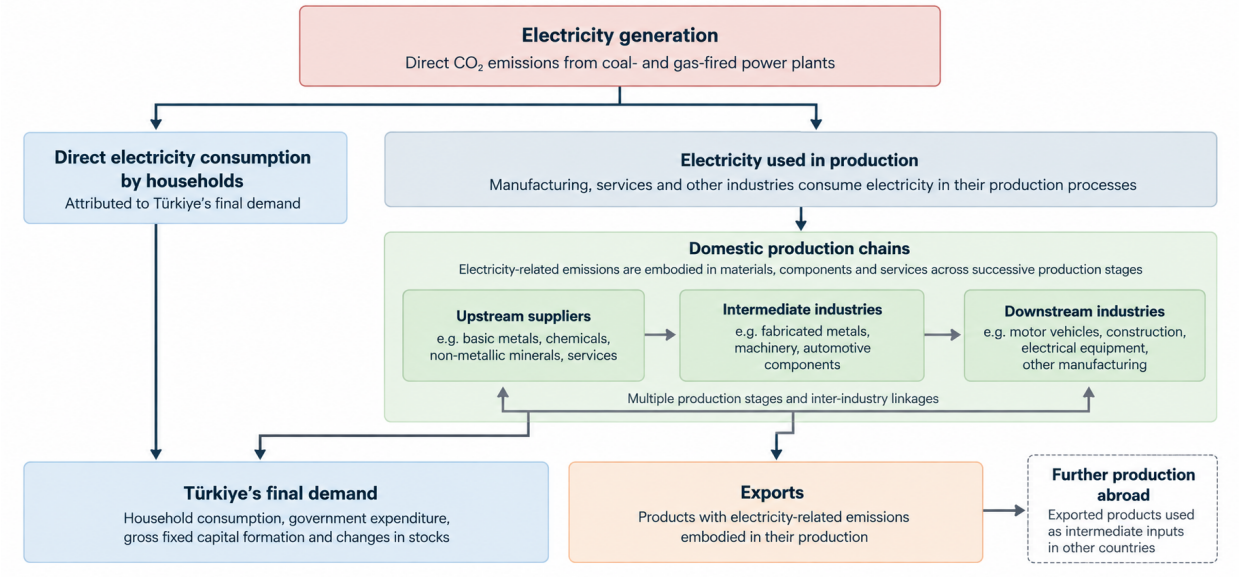
Electricity-related emissions contribute to a business's carbon footprint through both its own electricity consumption and the electricity used to produce the goods and services it purchases. As materials, components and services move through supply chains, electricity-generation emissions become part of the carbon footprint of downstream products.

This is particularly important for understanding industrial emissions in Türkiye. A manufacturer may have relatively low direct emissions and electricity consumption while relying on electricity-intensive materials and intermediate inputs. Türkiye's steel industry illustrates this connection: electricity generation abroad used to produce its imported inputs contributes more than 8 Mt $CO_2$ to the carbon footprint of domestic steel production. Electricity-generation emissions can therefore contribute to the footprint of final products through several stages of domestic and international production.

Electricity-related emissions reach different parts of the economy through several pathways. Electricity consumed directly by households is associated with Türkiye's final demand, while electricity used by manufacturing, services and other industries supports production activities. These industries are connected through successive stages of production, from upstream suppliers to intermediate producers and downstream industries. Their products may meet domestic final demand or be exported, including as intermediate inputs for further production abroad.

SEFiA's MRIO analysis traces these connections from the activities where emissions originate through successive stages of production and trade. This identifies not only the sectors generating emissions, but also the production chains and final demand connected to them.

**Figure 3. How electricity-related emissions are embodied in production and trade**




*Note: Conceptual illustration of electricity-related emissions across production chains. MRIO analysis traces emissions from electricity generation through successive production stages to domestic final demand and exports, including products used in further production abroad.*

These relationships have two important implications for industrial decarbonisation.

First, reducing emissions from electricity generation can benefit multiple industries simultaneously. Cleaner electricity lowers emissions associated with direct electricity consumption and those embodied in materials, components and services supplied to other sectors. These benefits can extend through successive production stages to final products consumed domestically or exported.

Second, industrial decarbonisation cannot be assessed solely through emissions generated within individual establishments. The carbon footprint of production also depends on upstream electricity, materials and services. Direct and supply-chain emissions represent different accounting perspectives and must be distinguished to avoid double counting.

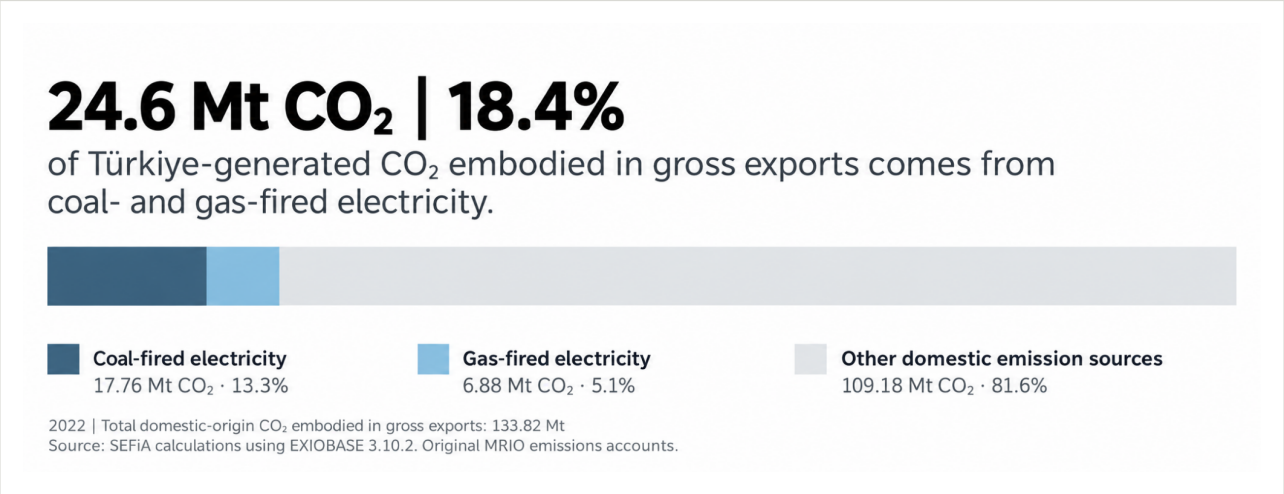
These production-chain connections explain how electricity-sector transformation can reduce the footprint of products whose final manufacturers use relatively little electricity themselves. They also connect domestic electricity policy to international trade: emissions from electricity used at different stages of production can be embodied in exported goods and services. Examining exports therefore reveals a further dimension of electricity generation's importance for Türkiye's industrial transformation.

## 5. ELECTRIFICATION ALONE IS NOT ENOUGH TO DECARBONISE TÜRKIYE'S EXPORTS

Electrification can reduce fossil-fuel use and improve energy efficiency in Türkiye's export-oriented industries. However, the carbon footprint of exported products also depends on how electricity is generated and the emissions embedded in materials and intermediate inputs. Cleaner electricity is therefore essential for maximising the benefits of industrial electrification.

SEFiA's MRIO analysis estimates that Türkiye's gross exports embodied approximately 191.4 Mt $CO_2$ in 2022, of which 70% (133.8 Mt $CO_2$) originated domestically. **Coal- and gas-fired electricity generation together contributed 24.6 Mt $CO_2$, accounting for 18.4% of these domestic-origin emissions: 13.3% (17.8 Mt $CO_2$) from coal and 5.1% (6.9 Mt $CO_2$)** from gas. This demonstrates that decarbonising electricity can reduce emissions embodied in exports even before additional industrial processes are electrified.

**Figure 4. Coal- and gas-fired electricity's contribution to Türkiye-generated $CO_2$ embodied in exports, 2022, Mt $CO_2$**




*Source: SEFiA calculations using EXIOBASE 3.10.2, 2022. Trade estimates retain the original MRIO emissions accounts. The denominator is domestically generated $CO_2$ embodied in gross exports.*

The contribution of electricity generation becomes clearer when emissions are traced through production chains. Cement, secondary steel, textiles and motor vehicles are among the major contributors to Türkiye's export carbon footprint when emissions are attributed to exporting sectors. However, part of this footprint originates upstream, including in electricity generation and the production of intermediate inputs.

Further electrification can replace direct fossil-fuel use among exporters and their suppliers in processes where electric alternatives are technically viable. The resulting emissions reductions depend on the efficiency of the technologies adopted and the carbon intensity of electricity generation. Energy efficiency improvements can further reduce energy requirements for a given level of production, limiting additional electricity demand as electrification expands. Cleaner electricity lowers emissions associated with both existing and newly electrified processes.

The contribution of coal- and gas-fired electricity to domestic-origin export emissions shows that electricity-sector decarbonisation is a shared priority across exporting industries and their suppliers. Renewable electricity expansion and a planned coal phase-out can lower existing export footprints, while further electrification can replace direct fossil-fuel use in processes where electric alternatives are technically viable. Energy efficiency and lower-carbon materials and processes remain necessary to reduce other sources of emissions.

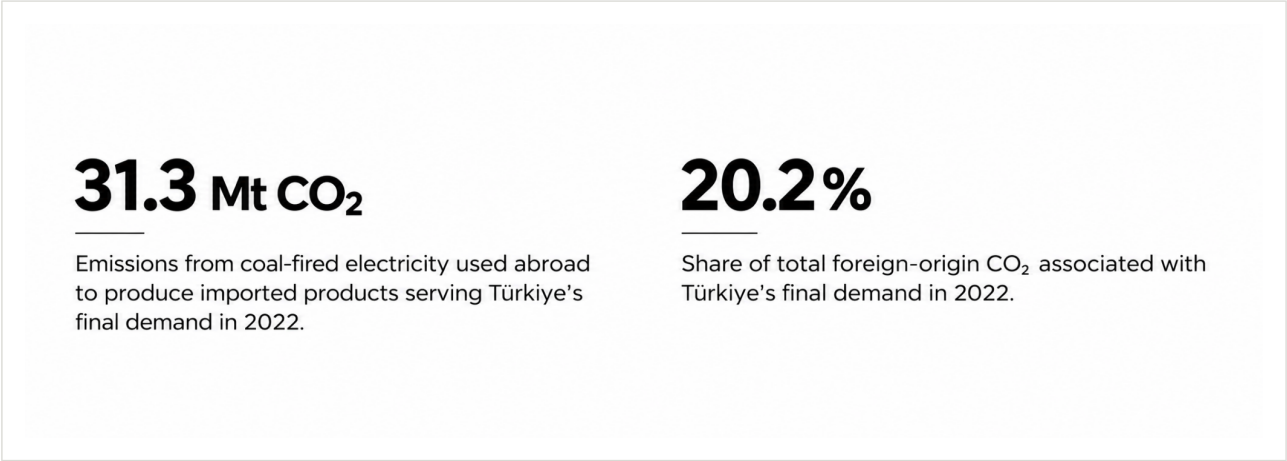
These measures can support Türkiye's transition towards lower-carbon exports. Their effects on competitiveness will also depend on energy prices, investment costs, market conditions and applicable trade requirements. The analysis identifies the emissions relationships through which electricity-sector transformation can contribute to this transition, rather than quantifying its competitiveness effects.

## 6. TÜRKIYE'S IMPORTS CARRY EMISSIONS FROM ELECTRICITY GENERATION ABROAD

Electrification can reduce fossil-fuel use and improve energy efficiency in Türkiye, but its wider emissions impact also depends on international production chains. Materials, components and equipment used in domestic production and consumption are often manufactured abroad, where electricity generation may remain carbon-intensive.

SEFiA's MRIO analysis identifies approximately 31.3 Mt $CO_2$ from coal-fired electricity used abroad to produce goods and services ultimately serving Türkiye's final demand in 2022. These emissions, embedded in imported products and their supply chains, represent 20.2% of all foreign-origin $CO_2$ associated with Türkiye's final demand.

**Figure 5. Foreign coal-fired electricity emissions associated with Türkiye's final demand, 2022**




*Source: SEFiA calculations using EXIOBASE 3.10.2, 2022. The share is calculated relative to total foreign-origin $CO_2$ emissions associated with Türkiye's final demand.*

These emissions arise through international production networks. Some are embodied in imported final products supplied directly to Türkiye's final demand, while others enter domestic production through imported materials, components and intermediate inputs. They may therefore be associated with products manufactured in Türkiye and ultimately serving its final demand, even when the electricity-related emissions originated abroad.

This finding adds an international dimension to the assessment of Türkiye's production, consumption and emissions structure. Domestic electricity-sector decarbonisation can lower emissions generated in Türkiye, including those embodied in exports. Emissions embedded in imports also depend on the electricity systems and production processes of trading partners.

The imported footprint therefore demonstrates why electricity-sector transformation must progress globally, across international production networks. A planned coal phase-out and renewable electricity expansion in Türkiye can reduce domestic emissions, while reductions in foreign-origin emissions also require cleaner generation and industrial decarbonisation abroad.

Better information on imported products' carbon intensity, low-carbon procurement and international cooperation can support these reductions. The results do not quantify the lifecycle emissions of particular electric technologies or the future effects of electrification.

For the COP31 agenda, the implication is that domestic action and international cooperation have complementary roles. Türkiye's electrification strategy should be grounded in the transformation of its own energy system while recognising the foreign production relationships that contribute to its consumption footprint.

## 7. CARBON PRICING AND TRADE POLICY MUST SUPPORT THE ELECTRICITY TRANSITION

Türkiye's emerging carbon pricing framework and the EU's Carbon Border Adjustment Mechanism (CBAM) reinforce the importance of coordinating electricity-sector decarbonisation with industrial transformation (Official Gazette, 2025; EU, 2023).

Depending on its design and level of ambition, Türkiye's national emissions trading system (ETS) can create incentives to reduce emissions from covered activities, including electricity generation and industrial production. However, carbon pricing alone does not ensure that industries can adopt efficient electric technologies or access affordable low-carbon electricity. Investment conditions, infrastructure availability and sector-specific technological requirements remain important.

This creates an important relationship between carbon pricing and electrification. As industries replace fossil-fuel-based processes with electric alternatives, direct emissions may decline while electricity consumption increases. The overall emissions outcome depends on the efficiency of the technologies adopted and the carbon intensity of electricity generation. Effective carbon pricing can support this transition by strengthening incentives to reduce emissions in both industrial production and electricity generation. Cleaner electricity and well-designed carbon pricing can therefore reinforce the emissions benefits of industrial electrification.

The EU's CBAM adds a trade dimension for covered products. Its current regulatory calculation boundaries differ from the economy-wide carbon footprint approach used in this brief. Extending the coverage of electricity-related indirect emissions to additional products would further strengthen the relevance of electricity-sector decarbonisation for exporters. However, the emissions embodied in exports identified through MRIO analysis should not be interpreted as CBAM liabilities or product-level compliance values (EU, 2023).

For Türkiye, these policies highlight the importance of coordinated investment in energy efficiency, cleaner electricity, industrial electrification and other low-carbon production technologies. Carbon pricing and trade measures can influence investment incentives, but the availability and affordability of clean energy and suitable technologies will remain central to industrial decarbonisation.

# 8. COP31: ELECTRIFICATION COMMITMENTS MUST DELIVER REAL EMISSIONS REDUCTIONS

COP31 offers an opportunity to accelerate electrification as part of the global transition away from fossil fuels. Türkiye's proposed 35-by-35 Global Electrification Pledge, which aims to increase electricity's share of global final energy consumption to 35% by 2035, provides a framework for expanding electric technologies across industry, transport, buildings and other sectors (COP31 Presidency, 2026).

However, increasing electricity's share of final energy consumption does not automatically deliver emissions reductions consistent with climate goals. Electrification can replace fossil-fuel use and deliver substantial energy efficiency gains, but its climate impact depends on the technologies adopted, the fossil fuels displaced and the carbon intensity of electricity generation. Meeting climate goals requires broader and faster emissions reductions than renewables-based electrification alone can deliver. Electrification must therefore be accompanied by energy efficiency, sufficiency measures that reduce avoidable energy and material demand while ensuring access to essential services, an accelerated phase-out of fossil fuels, and changes in industrial processes and material use that address emissions beyond the reach of electrification.

These concerns are reflected in *Electrification done right: civil society conditions for the "35 by 35" target*, an open letter to the COP31 Presidencies published in September 2026. The signatories condition their support on renewables-based electrification that reduces fossil-fuel dependence, prioritises energy efficiency and sufficiency, closes energy-access gaps and is delivered through national targets and policies. The letter also calls for community rights in grid and storage development, public finance and implementation support, and safeguards across transition-mineral supply chains (CSOs, 2026).

SEFiA's analysis shows what Türkiye's existing production and emissions structure implies for implementing this agenda. Electricity generation is both a major source of domestic $CO_2$ emissions and an input whose footprint extends across manufacturing, consumption and exports. Its decarbonisation can therefore support emissions reductions across existing economic activities, alongside the contribution of further electrification.

Coal-fired generation's large share of emissions makes a planned coal phase-out central to this transformation. Manufacturing industries' electricity-related footprint demonstrates the importance of cleaner supply for current production, while the export results show how these benefits can extend through domestic suppliers. The imported footprint highlights the complementary role of electricity-sector decarbonisation abroad.

These findings support an approach in which electrification commitments are implemented through coordinated energy and industrial policies. Renewable electricity deployment, a planned coal phase-out, energy efficiency and sector-specific technological changes should contribute to a common objective of reducing fossil-fuel use and emissions in line with climate goals.

# 9. EIGHT PRIORITIES FOR A CREDIBLE COP31 ELECTRIFICATION AGENDA

The following eight priorities connect SEFiA's findings and the conditions outlined in the civil society open letter to Türkiye's energy, industrial and trade policies.

For Türkiye, these priorities form three connected areas of action: a planned coal phase-out and renewable electricity expansion, energy efficiency and sector-specific industrial transformation, and the infrastructure, finance, policy coordination and just-transition measures needed for implementation. Progress should be assessed through measurable improvements in energy efficiency and reductions in fossil-fuel use and emissions.

## 1. Link electrification targets to electricity-sector decarbonisation.

Electrification commitments should be accompanied by credible pathways for reducing both the carbon intensity and absolute emissions of electricity generation. Renewable electricity deployment and the progressive reduction of fossil-fuel-based generation must advance alongside growing electricity demand, supported by investment in grids and flexibility resources, including storage and demand-side management. For Türkiye, this requires a clear timetable for phasing out coal-fired generation, coordinated with renewable electricity deployment and electricity-system investment.

National strategies should assess whether additional electricity consumption is being met by increasingly low-carbon generation. Cleaner electricity is also essential for reducing emissions associated with existing electricity use, independently of further electrification.

## 2. Make energy efficiency and fossil-fuel displacement central objectives.

Electrification should aim to reduce fossil-fuel consumption and improve the efficiency of energy use. Electric vehicles, heat pumps and suitable industrial electric technologies can provide substantial efficiency advantages over combustion-based alternatives. Improvements in existing buildings, equipment and industrial processes can further reduce energy requirements. National targets should therefore measure fossil-fuel consumption displaced and energy savings achieved alongside electrification progress. Alongside efficiency improvements, policies should address avoidable energy and material demand while ensuring access to essential services.

## 3. Develop sector-specific industrial electrification pathways.

Industrial electrification strategies must reflect differences in production technologies, energy requirements and emissions sources. Electricity-intensive industries such as Türkiye's predominantly EAF-based secondary steel sector can benefit from cleaner electricity, while suitable heating processes in textiles, food processing and other industries offer opportunities for further electrification.

Other industries, including cement and chemicals, require complementary measures addressing high-temperature heat, process emissions and fossil-fuel-based feedstocks. Sectoral roadmaps should combine energy efficiency, electrification, cleaner electricity and broader technological changes.

### 4. Coordinate electrification with carbon pricing, trade and industrial policy.

Electrification strategies should be integrated with carbon pricing, industrial investment and decarbonisation policies. For Türkiye, this requires coordination between the domestic ETS, electricity-sector transformation and sectoral industrial roadmaps.

The EU's CBAM links the emissions intensity of covered exports to carbon costs in the EU market. Türkiye's Climate Law also allows for a national carbon border adjustment mechanism, making coordination between import-related carbon policies, the national ETS and industrial decarbonisation important (Official Gazette, 2025). Together, these policies should support cleaner domestic production and lower-carbon sourcing. Their regulatory emissions boundaries differ from the economy-wide carbon footprint accounting used in this brief.

### 5. Address emissions across domestic and international production chains.

Electrification strategies should consider emissions beyond the establishments adopting electric technologies. Electricity-related emissions are embedded in materials, components and services supplied through domestic and international production networks.

For Türkiye, reducing emissions from electricity generation can lower the carbon footprint of existing industrial production and exports, while further electrification may change emissions across supply chains. Strategies should encourage energy efficiency, cleaner electricity and lower-carbon inputs among suppliers, supported by better emissions information and international cooperation.

### 6. Ensure equitable access to clean electricity and a just transition

The benefits of electrification depend on access to reliable and affordable electricity and efficient electric technologies. High upfront investment costs, electricity prices and infrastructure constraints can limit adoption, particularly among low-income households and smaller enterprises. Public policy should address these barriers through appropriate financing, targeted support and equitable cost-sharing arrangements, ensuring that the benefits of cleaner electricity and improved efficiency are widely shared.

A planned coal phase-out should be accompanied by measures addressing employment, social protection and economic diversification in affected regions. Workers and local communities should participate meaningfully in the preparation and implementation of transition plans.

### 7. Align electricity infrastructure and finance with future demand.

Electrification requires coordinated investment in renewable generation, transmission and distribution networks, storage, flexibility and demand-side management.

Electricity-system planning must account for the location, timing and scale of additional demand from industry, transport and buildings. Energy efficiency and demand management should be incorporated to limit unnecessary infrastructure investment. Public finance and international cooperation can help address high upfront costs.

### 8. Measure emissions outcomes, not only electrification progress.

The success of electrification should be measured by its contribution to improving energy efficiency and reducing fossil-fuel dependence and greenhouse gas emissions.

Monitoring frameworks should track improvements in energy efficiency, fossil-fuel consumption displaced by electric technologies, electricity's share of final energy use, and both the carbon intensity and absolute emissions of electricity generation.

Sectoral monitoring should distinguish direct fossil-fuel emissions from electricity-related emissions, while production-chain indicators can provide additional information on emissions embodied in domestic production, exports and international supply chains.

Together, these indicators can show whether electrification is delivering emissions reductions across the economy rather than merely changing where energy is consumed and emissions are generated.

# DATA SOURCES AND METHODOLOGY

This brief draws on SEFiA's analysis of the EXIOBASE 3.10.2 multiregional input-output (MRIO) tables for 2022, physical electricity statistics published by TÜİK for 2022 and 2023, and the MoENR's 2022 average electricity-generation emissions factor. It combines adjusted production-based emissions estimates, physical electricity-use estimates and MRIO-based production-chain tracing. All emissions estimates are expressed as $CO_2$.

**Production-based emissions**: Production-based accounting attributes emissions to the economic activities where they originate. EXIOBASE provides the baseline direct emissions from electricity generation, manufacturing and other economic activities in Türkiye.

Electricity-generation emissions are adjusted using physical generation data and MoENR's 2022 average generation emissions factor of 0.438 t $CO_2$/MWh, giving a total of 143.83 Mt $CO_2$, compared with 128.70 Mt $CO_2$ in the baseline. The adjusted total is allocated across generation sources in proportion to their original EXIOBASE emission shares. Coal- and gas-fired generation estimates therefore represent proportional adjustments, rather than independently calculated fuel-specific emissions inventories.

Holding direct emissions from other activities unchanged, this adjustment increases production-based emissions from economic activities from 396.56 to 411.69 Mt $CO_2$. Including 67.42 Mt $CO_2$ of household direct emissions brings the adjusted total to 479.11 Mt $CO_2$.

**Electricity consumption and industrial emissions**: TÜİK's physical electricity-use statistics are combined with MoENR's 2022 average electricity-generation emissions factor of 0.438 t $CO_2$/MWh (438 g $CO_2$/kWh) to estimate electricity-related emissions across economic activities and households.

Detailed manufacturing estimates use TÜİK's 2023 sectoral electricity-consumption distribution, scaled to the corresponding 2022 activity totals. They therefore represent estimated electricity use and associated emissions for 2022, rather than observed 2022 consumption at every detailed industry level or estimates of actual 2023 emissions. These calculations provide indicative estimates based on a common generation emissions factor. They are not facility-specific Scope 2 inventories under the GHG Protocol and do not distinguish electricity-grid connection levels, company-specific procurement or contractual instruments.

The electricity-related footprint of iron and steel is allocated between basic iron and steel and secondary steel using their shares in the original EXIOBASE Scope 2 estimates: 17.31% and 82.69%, respectively. This split is an allocation assumption rather than independently observed electricity consumption by production route.

Electricity-use estimates describe emissions from the users' perspective and should not be added to emissions already attributed to power generation. Differences in statistical coverage and accounting boundaries mean that the electricity-use estimates and the adjusted generation total do not constitute a fully reconciled electricity balance.

**Production-chain and trade emissions**: The EXIOBASE MRIO framework traces emissions from their source activities through intermediate production, international trade and final demand. It distinguishes domestic- and foreign-origin emissions embodied in Türkiye's exports and final demand, including emissions from coal-fired electricity used throughout production chains.

Production-chain and trade estimates retain the original EXIOBASE emissions accounts. The adjustment to Türkiye's electricity-generation emissions is not applied to these calculations. Consequently, the adjusted production-based totals should not be combined with the trade estimates to construct a single production–

consumption accounting balance. Emissions from electricity generation abroad associated with Türkiye's final demand include those embedded in imported final products and in imported inputs used in domestic production serving that demand.

**Interpretation and limitations:** The findings describe existing emissions relationships in the economy rather than the emissions-reduction potential of future electrification. Assessing future impacts requires information on the fossil-fuel technologies displaced, efficiency gains, additional electricity demand and changes in electricity supply. The estimates have different accounting boundaries and calculation requirements from verified emissions reported under Türkiye's ETS or product-level embedded emissions calculated under the EU's CBAM.

# References and source material

**Civil society organisations, networks and movements (CSOs) (2026).** *Electrification done right: civil society conditions for the "35 by 35" target. Open letter to the COP31 Presidencies.* September 2026. https://oilchange.org/wp-content/uploads/2026/09/Electrification-done-right_-civil-society-conditions-for-the-35-by-35-target-1.pdf

**COP31 Presidency (2026).** 35-by-35 Global Electrification Pledge. https://cop31.tr/news-detail/cop31-35-by-35-global-electrification-pledge

**European Union (EU) (2023).** *Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism, as amended.* https://eur-lex.europa.eu/eli/reg/2023/956/oj

**EXIOBASE.** *EXIOBASE 3.10.2 multiregional input-output tables, 2022 dataset.*

**International Energy Agency (IEA) (2020).** *Iron and Steel Technology Roadmap: Towards more sustainable steelmaking.* Paris: IEA. https://www.iea.org/reports/iron-and-steel-technology-roadmap

**International Energy Agency (IEA) (2026).** *Electrification.* Paris: IEA. https://www.iea.org/reports/electrification

**Intergovernmental Panel on Climate Change (IPCC) (2022).** *Climate Change 2022: Mitigation of Climate Change.* Contribution of Working Group III to the Sixth Assessment Report. Chapter 11: Industry. https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-11/

**Ministry of Energy and Natural Resources (MoENR) (2024).** *Türkiye Elektrik Üretimi ve Elektrik Tüketim Noktası Emisyon Faktörleri Bilgi Formu.* Calculation period: 2022. Published 6 December 2024. https://enerji.gov.tr/Media/Dizin/EVCED/tr/%C3%87evreVe%C4%B0klim/%C4%B0klimDe%C4%9Fi%C5%9Fikli%C4%9Fi/EmisyonFaktorleri/2022_Uretim_Tuketim_EF.pdf

**Ministry of Industry and Technology (MoIT) (n.d.).** *Steel Sector.* Türkiye Industrial Decarbonization Investment Platform (TIDIP). Accessed 25 October 2026. https://tidip.sanayi.gov.tr/en/sectors/steel

**Official Gazette (2025).** *Climate Law No. 7552.*

**Turkish Statistical Institute (TÜİK).** *Physical electricity consumption statistics, 2022 and 2023.*



SUSTAINABLE ECONOMICS AND FINANCE ASSOCIATION (SEFiA)

NOVEMBER 2026