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# Optimal design of Turkey's emission trading system: Lessons from the EU and global best practices[*] [1]

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## Abstract

The paper aims to analyze the challenges and opportunities of establishing a Turkish Emissions Trading System (ETS) in light of the European Green Deal (EGD) and its Carbon Border Adjustment Mechanism (CBAM) by reviewing global ETS practices, particularly the EU ETS, to highlight potential shortcomings in the Turkish system.

Türkiye's Emissions Trading System (ETS) development, initiated in 2015 with its Monitoring, Reporting, and Verification (MRV) framework, faces critical design challenges that may undermine its effectiveness. The current inclusion threshold of 500 kt $CO_2$/year for Category C installations risks excluding significant emitters in key sectors—a limitation that could be addressed by adopting the EU ETS's activity-specific criteria. Furthermore, while Türkiye's proposed cap aligns with its 2023 Nationally Determined Contribution (NDC), independent analyses highlight its inadequacy for Paris Agreement compliance, projecting a 2030 emissions level (695 $MtCO_2e$) vastly exceeding a 1.5°C-compatible "fair share" (433.9 $MtCO_2e$). Without stringent adjustments, the TR ETS may generate a 17-million-unit allowance surplus by 2027, collapsing carbon prices and granting windfall profits to high emitters. However, strategically allocated ETS revenues (€2.1–2.5 billion annually at €10/allowance) could accelerate decarbonization through renewable energy investments, industrial efficiency

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programs, and just transition mechanisms—provided complementary policies address existing fossil fuel subsidies and ensure policy coherence.

The analysis revealed the importance of a stringent, declining cap aligned with climate targets, contrasting Türkiye's current NDC projections with historical emission trends and 1.5-degree compatibility scenarios. Finally, we discuss the potential revenues from a Turkish ETS and suggest their strategic reinvestment for a sustainable economic transition.

*Key words:* European green deal; carbon border adjustment mechanism; Turkish emission trading system.

*JEL codes:* D57; C67; Q56.

## 1. Introduction

The European Green Deal (EGD), launched by the European Commission in December 2019, represents a comprehensive policy framework aimed at achieving climate neutrality within the European Union (EU) by 2050. While the EGD primarily targets EU member states, its regulatory and economic mechanisms extend beyond the bloc, affecting third countries with significant trade relations with the EU. One of the most consequential elements of the EGD is the Carbon Border Adjustment Mechanism (CBAM), which is designed to impose a carbon price on greenhouse gas (GHG) emissions embedded in certain carbon-intensive goods imported into the EU market. The transitional phase of CBAM began in October 2023, with full implementation scheduled for January 1, 2026.

A central objective of CBAM is to prevent carbon leakage, a phenomenon wherein EU-based industries relocate production to jurisdictions with weaker climate policies, thereby undermining global emissions reduction efforts. By imposing a carbon cost on imports of select goods—such as cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen—the EU seeks to incentivize non-EU nations to adopt robust carbon pricing mechanisms, either in the form of: Carbon taxes, or Emissions Trading Systems (ETS). This regulatory push aligns with the polluter-pays principle, ensuring that industries contributing to global emissions bear proportionate financial responsibility.

Countries with high export exposure to the EU, such as Türkiye, must adapt to CBAM to maintain market competitiveness. Türkiye, which exports over €100 billion annually to the EU—including CBAM-covered goods like steel, cement, and aluminum—faces significant financial risks if it fails to implement equivalent carbon pricing. Preliminary estimates suggest that Turkish exporters could incur €2–5 billion in additional costs per year by 2030 unless domestic decarbonization policies accelerate (EBRD, 2023).

Türkiye's climate policy has been shaped by its unique position as an Annex I party under the UNFCCC without binding mitigation commitments. Despite being

a candidate for EU membership and a founding member of the OECD, Türkiye's climate policies have shown limited progress in addressing climate change effectively. Despite having various policies and institutions in place, Türkiye's climate actions have been limited, often not confronting developmental ambitions (Turhan, et al., 2016), reflected in the 162.2% increase in GHGs between 1990 and 2023.

The EU accession negotiations have played a role in pushing Türkiye's environmental agenda forward, but significant policy shifts are still needed (Balaban, 2019). International agreements like the Paris Agreement and the European Green Deal have the potential to influence Türkiye's climate policy.

Following the announcement of the European Green Deal (EGD) in late 2019, Turkish policymakers have systematically engaged in monitoring and strategic planning initiatives. In February 2020, an inter-ministerial working group was constituted under the auspices of the Ministry of Trade to coordinate national responses (Republic of Türkiye Ministry of Trade, 2021). This institutional effort culminated in July 2021 with the formal adoption of the European Green Deal Action Plan (EGDAP), a comprehensive policy framework encompassing 81 discrete actions and 32 measurable targets distributed across nine thematic areas. The plan prioritizes sectoral decarbonization strategies, instituting a domestic emission trading system, adaptation mechanisms for the Carbon Border Adjustment Mechanism (CBAM), climate change mitigation protocols, and the transition toward circular economic models.

Subsequent developments in February 2022 included the convening of Türkiye's inaugural Climate Council, which produced a series of policy recommendations intended to inform the drafting of national climate legislation (Republic of Türkiye Ministry of Environment, Urbanization and Climate Change, 2022). This policy trajectory was further reinforced in October 2022 when Türkiye ratified the Paris Agreement and formally committed to achieving carbon neutrality by 2053, thereby aligning its long-term climate strategy with international obligations under the UNFCCC framework.

Türkiye has been actively developing a national Emission Trading System (ETS) as part of its broader climate policy framework to align with global decarbonization efforts and the European Green Deal (EGD). The system, currently in its pilot phase, is expected to be formally launched in 2026, with pilot programs already underway to test carbon pricing mechanisms. Modeled partially after the EU ETS, Türkiye’s system aims to regulate greenhouse gas (GHG) emissions from energy-intensive sectors, including cement, steel, and power generation, while addressing competitiveness concerns related to the EU Carbon Border Adjustment Mechanism (CBAM). A critical step toward implementation was the establishment

of a legal and institutional framework, including the Turkish Climate Law (expected to be adopted by the parliament in 2025) and the creation of an ETS under the supervision of the Ministry of Environment, Urbanization, and Climate Change. The system is expected to initially cover large industrial emitters, with gradual expansion to additional sectors. Key challenges include ensuring market liquidity, preventing carbon leakage, and integrating Türkiye's ETS with international carbon markets. If successfully implemented, the system could enhance emission reduction efforts, foster green investments, and support Türkiye's 2053 net-zero target. However, its effectiveness will depend on stringent caps, transparent monitoring, and alignment with global carbon pricing trends.

Turkish stakeholders hold mixed views on the country's Emission Trading System (ETS). The government supports it as a necessary step to align with the EU's Carbon Border Adjustment Mechanism (CBAM) and avoid trade penalties, but faces criticism for setting an unambitious emissions cap that may fail to meet Paris Agreement targets. Export-driven industries, such as cement and steel, generally back the ETS as a way to mitigate CBAM costs but demand free allowances and fear high compliance burdens. Domestic energy-intensive sectors resist strict regulations, citing economic risks. Environmental groups and academics criticize the system's high emissions threshold (500 kt $CO_2$/year) and weak cap, warning it could lead to carbon price crashes and windfall profits for polluters. They urge stricter targets, reinvestment of ETS revenues into renewables, and an end to fossil fuel subsidies. Overall, while stakeholders recognize the ETS's potential, concerns persist over its design, transparency, and ability to drive meaningful decarbonization without harming industrial competitiveness.

This paper examines potential shortcomings in Türkiye's Emissions Trading System (ETS) through a comparative analysis of global ETS frameworks, with particular emphasis on the EU ETS due to its structural similarities with Türkiye's proposed system.

## 2. Literature review

Climate change mitigation requires economically efficient policy instruments to internalize the social cost of greenhouse gas (GHG) emissions. Two dominant market-based mechanisms have emerged globally: Emissions Trading Systems (ETS) and Carbon Taxes (CT). Both aim to reduce emissions by assigning a price to carbon, but they differ in design, implementation, and economic implications. An ETS sets a regulatory limit (cap) on total emissions and allows firms to trade emission permits, creating a market-driven carbon price. Prominent examples include the EU ETS (the world's largest carbon market) and China's national ETS. In contrast, a Carbon Tax imposes a fixed price per ton of $CO_2$ emissions, providing

price certainty but leaving emission reductions to market responses (e.g., Sweden's $130/ton tax).

The choice between these mechanisms involves trade-offs. While ETS ensures emission certainty but suffers from price volatility (e.g., EU ETS prices swinging from €5/ton €100/ton), Carbon Taxes offer price stability but lack guaranteed emission cuts unless adjusted dynamically. Empirical studies suggest that both systems can reduce emissions effectively, but their success depends on policy stringency, sectoral coverage, and revenue recycling mechanisms. Hybrid systems (e.g., California's ETS with price floors) are gaining traction to balance these trade-offs.

According to the World Bank's Carbon Pricing Dashboard dataset, as of the end of 2024, there are 36 (regional and subnational) ETS initiatives implemented, 3 scheduled, and 22 under consideration. These 36 ETS initiatives cover 8.91 $GtCO_2e$, which accounts for 18% of global emissions. In terms of the share of global emissions in 2023, the biggest initiative is the Chinese National ETS, which became operational in 2021, that covers 4.5 $GtCO_2e$ (9.3% of global emissions). It is followed by the EU ETS covering 1.4 $GtCO_2e$, which accounts for 2.6% of global emissions.

The effectiveness of ETS in reducing emissions has been studied across various regions and contexts. For instance, the EU, California, and South Korea have implemented robust ETS structures that have led to emissions reductions (Narassimhan et al., 2018). In China, pilot ETS programs have reduced carbon emissions by approximately 16.2% in certain regions (Zhang et al., 2020), and improved energy efficiency by about 7.5% (Du et al., 2022). This dual benefit is also observed in other regions where ETS has been implemented, suggesting that ETS can simultaneously address emissions and energy efficiency (Zhang et al., 2020).

On the economic and environmental co-benefits nexus, ETS has been associated with economic benefits, such as increased industrial output value, while significantly reducing $CO_2$ emissions (Wei Zhang et al., 2020). Additionally, ETS has been effective in reducing the use of fossil fuels and increasing the adoption of renewable energy (Bai and Ru, 2022).

The governance of carbon markets is crucial for addressing risks to environmental integrity. Betz et al. (2022) provide a principle-based overview of the challenges faced by carbon markets, including potential abuses and the need for effective policy solutions. Their analysis suggests that comprehensive governance structures are necessary to mitigate risks and enhance the overall effectiveness of emission trading systems. In conclusion, the effective design of emission trading

systems requires a multifaceted approach that incorporates technological innovation, robust regulatory frameworks, and comprehensive governance.

The effectiveness of ETS is often enhanced by reinvesting auction revenues into further emissions-reduction activities and by encouraging cleaner production practices among enterprises (Narassimhan et al., 2018; Du et al., 2022). In China, ETS has also promoted the development of low-carbon technologies and optimized energy structures (Tang et al., 2020).

The EU Emissions Trading System (EU ETS) and Türkiye's Emissions Trading System (ETS) share key similarities. Both systems target energy-intensive sectors, such as refinery products, paper, chemicals, non-metallic minerals, basic metals, and electricity, to promote cost-effective emission reductions. A brief comparison of the two system is given in Table 1.

**Table 1**
EU ETS versus Turkish ETS

| Feature | EU ETS | Turkish ETS |
|---|---|---|
| Launch Year | 2005 | 2024 (pilot) |
| GHG Coverage | $CO_2$, $N_2O$, PFCs | $CO_2$ only (for now) |
| Carbon Price | €60-100 | ~$10-20 (expected) |
| Allocation | Free + Auctions | Grandfathering (initially) |
| Penalties | €100/ton | Lower (TBD) |
| Market Maturity | Highly liquid | Early stage |

However, significant differences exist, particularly in scope and stringency. The EU ETS, operational since 2005, is one of the world's largest and most established carbon markets, covering multiple sectors with a declining cap aligned with climate targets. In contrast, Türkiye's ETS, launched in 2024 under its Carbon Regulation, is still in its early stages, with a slightly less sectoral coverage. Although not being officially determined yet, the Turkish cap is more likely to be less aggressive. Additionally, while the EU ETS is linked to international carbon markets, Türkiye's system remains domestic, with future expansions dependent on policy developments. These differences highlight Türkiye's emerging approach compared to the EU's more mature and stringent framework.

Türkiye can learn several key lessons from the EU ETS experience to enhance the effectiveness of its own emissions trading system. First, the EU's phased

approach—starting with a pilot phase, expanding coverage over time, and gradually tightening caps—demonstrates the importance of flexibility and incremental progress in building a robust carbon market. Second, the EU ETS highlights the need for strong monitoring, reporting, and verification (MRV) mechanisms to ensure transparency and prevent market abuse. Third, Türkiye could benefit from the EU's experience with price stabilization measures, such as the Market Stability Reserve (MSR), to mitigate excessive price volatility. Finally, aligning its ETS with international carbon markets, as the EU has done, could improve liquidity and cost efficiency. By adopting these best practices while tailoring them to its economic and industrial context, Türkiye can strengthen its ETS and achieve more effective emissions reductions.

The EU ETS has come under criticisms on several fronts which can also help calibrate the Turkish ETS. First of all, critics argue that the EU ETS has not significantly reduced carbon emissions or spurred sufficient low-carbon innovation. While some abatement has occurred, it is considered small and insufficient to meet climate goals (Branger et al., 2015; Dirix et al., 2015). This underpins the importance of binding caps. and share of free allowances in the system. Then there are concerns about competitiveness losses and carbon leakage, where industries might relocate to regions with less stringent emission controls. Carbon leakage has long been put forward in justfying free allowances. However, evidence suggests that these issues have not materialized significantly, although they remain a potential risk (Branger et al., 2015). A detailed analysis should be carried out to determine the actual carbon leakage risk level of industries before granting them allowances for free after the pilot phase. EU ETS has, also, been criticized for its unfair distributional effects, where the burden of compliance may disproportionately affect certain sectors or communities, leading to economic disparities (Dirix et al., 2015). Moreover, the EU ETS has been susceptible to fraud and market inefficiencies, such as low allowance prices that undermine the system's dynamic efficiency and effectiveness in reducing emissions (Perthuis and Trotignon, 2014). Overall, the EU ETS experience could serve as a guide in designing the Turkish ETS effectively.

## 3. Data

According to the draft carbon market regulation (EPDK, 2024) announced in November 2023, the Turkish Emissions Trading System (ETS) will begin in 2026. The first step in establishing an ETS in Türkiye began with the establishment of a Monitoring-Reporting-Verification (MRV) system in 2015. According to the ETS regulation, installations in the electricity, refinery, non-metallic minerals, basic metals, paper, and the chemicals sectors emitting above a certain level of greenhouse gases (GHGs) (> 500 kt$CO_2$e) will be covered under the new system.

The pilot phase of the Turkish ETS started on October 15, 2024 with the announcement of national allowance allocations. Following a two-year transition period, the first implementation phase will start on October 15, 2026. The outline of the system is as follows:

The proposed Climate Law mandates that GHG emission reductions and climate change adaptation measures be subject to annual monitoring by the Directorate of Climate Change, an administrative body under the Ministry of Environment, Urbanization and Climate Change. The Directorate is tasked with formulating national allocation plans and distributing emission allowances, while Energy Exchange Istanbul (EPİAŞ) is designated to administer primary and secondary markets for allowance trading. Participation in the ETS necessitates obtaining GHG emission permits, with existing facilities required to maintain compliance and new entrants obligated to secure permits prior to operational commencement. Notably, ETS allowance transactions are exempt from Public Procurement Law provisions to ensure market efficiency and liquidity.

Further institutionalizing the system, a draft Carbon Markets Regulation, released for public consultation by the Energy Market Regulatory Authority (EMRA) in November 2023, outlines additional operational mechanisms pending final legislative approval. The ETS is structured to internalize carbon costs within Türkiye's economy, facilitating industrial decarbonization while mitigating competitiveness risks. Notably, exporters subject to the EU's CBAM may offset liabilities by demonstrating domestic carbon pricing compliance. Governance responsibilities are distributed across three key entities: (i) The Carbon Market Board, responsible for strategic policy decisions; (ii) The Directorate of Climate Change, overseeing allowance allocation, emissions monitoring, and credit regulation; and (iii) EPİAŞ, managing market operations and financial oversight.

The regulatory framework permits the limited use of carbon credits for ETS compliance, with the Directorate establishing national crediting methodologies and project registration requirements. Project developers operating under voluntary carbon standards must register initiatives within stipulated timelines to ensure alignment with national climate objectives.

The proposal establishes a graduated sanctions regime for non-compliance, including:

- Late or missing emissions reports (₺500,000-5,000,000, doubled for ETS participants)
- Ozone-depleting substance violations (₺2,500,000 for corporate entities; ₺250,000 for individuals)
- Progressive penalties for ETS violations including allowance freezes and permit revocations

While the Directorate retains ultimate oversight authority, provincial Ministry offices may conduct on-site inspections as needed.

MRV data is collected by the Ministry of Environment, Urbanization, and Climate Change. As of 2020, 476 installations under the Turkish MRV system emitted 251 Mt $CO_2$e of GHG, which corresponds to 47.2% of total emissions (524 Mt$CO_2$e). The analysis below employs this dataset.

The Turkish MRV categorizes installations under three groups: Category A includes installations with emissions lower than 50 kt$CO_2$e; Category B installations with emissions between 50 and 500 kt$CO_2$e; and Category C installations with emissions higher than 500 kt$CO_2$e. Table 2 presents key statistics for the Turkish MRV system.

**Table 2**
Key Statistics on the Turkish MRV System in 2020

| | Category A | | Category B | | Category C | | Total | |
|---|---|---|---|---|---|---|---|---|
| Activity | Emissions (Mt$CO_2$e) | N | Emissions (Mt$CO_2$e) | N | Emissions (Mt$CO_2$e) | N | Emissions (Mt$CO_2$e) | N |
| Non-Ferrous Metals | 0.0 | 0 | 0.7 | 9 | 0.2 | 1 | 0.9 | 10 |
| Plaster | 0.2 | 9 | 0.0 | 0 | 0.0 | 0 | 0.2 | 9 |
| Aluminum | 0.1 | 5 | 0.1 | 2 | 0.6 | 1 | 0.9 | 8 |
| Glass | 0.2 | 7 | 2.1 | 12 | 0.0 | 0 | 2.4 | 19 |
| Cement | 0.0 | 0 | 1.3 | 4 | 66.3 | 53 | 67.6 | 57 |
| Lime | 0.0 | 3 | 2.2 | 22 | 0.5 | 1 | 2.8 | 26 |
| Ceramics | 0.5 | 27 | 1.7 | 17 | 0.3 | 1 | 2.5 | 45 |
| Bricks | 0.6 | 86 | 0.1 | 3 | 0.3 | 1 | 1.0 | 90 |
| Mineral Wool | 0.1 | 6 | 0.1 | 3 | 0.0 | 0 | 0.2 | 9 |
| Iron | 0.3 | 18 | 2.1 | 21 | 0.0 | 0 | 2.4 | 39 |
| Pig Iron-Steel | 0.1 | 7 | 2.3 | 11 | 30.0 | 6 | 32.3 | 24 |
| Electricity | 0.1 | 5 | 1.6 | 14 | 116.3 | 49 | 118.0 | 68 |
| Paper | 0.6 | 30 | 1.5 | 14 | 0.7 | 2 | 2.8 | 46 |
| Chemicals | 0.2 | 11 | 0.9 | 3 | 7.9 | 7 | 9.0 | 21 |
| Refinery Products | 0.0 | 0 | 0.1 | 1 | 7.6 | 4 | 7.6 | 5 |
| Total | 3.0 | 214 | 16.7 | 136 | 230.7 | 126 | 250.5 | 476 |
| *% of MRV Emissions* | 1.2 | | 6.7 | | 92.1 | | 100 | |
| *% of Total Emissions* | 0.6 | | 3.2 | | 44.4 | | 48.2 | |

*Source*: Turkish Ministry of Environment, Urbanization and Climate Change[2]

[2] Turkish MRV data is not publicly available. The present dataset is obtained upon request from the ministry.

By 2020, the Turkish MRV covered 476 installations, of which 214 belonged to Category A, 136 belonged to Category B, and 126 belonged to Category C.

In 2020, the Turkish MRV covered 251 Mt $CO_2$e (47.2% of 524 Mt $CO_2$e in 2020). Category A, Category B, and Category C installations emitted 1.2%, 6.7%, and 92.1% of emissions covered under the Turkish MRV, respectively. In other words, Category C installations %44.4 of the total emissions.

## 4. Analysis

According to official statements, the pilot phase of the Turkish ETS will initially encompass only Category C installations. While these installations represent the dominant share of emissions, this selective coverage raises significant concerns regarding sectoral comprehensiveness. As evidenced in Table 3, the exclusion of non-Category C facilities would result in the systematic omission of greenhouse gas emissions from key industrial sectors, including plaster, glass, mineral wool, and iron production (2020 baseline data). This limited scope creates notable gaps in the system's emissions accounting framework during its formative phase.[3].

Table 3 presents the average emissions of installations covered under the Turkish MRV and the EU ETS.

[3] Note that these figures reflect the situation as of 2020 (the latest year for which data is available) and that installation coverage will different when the Turkish ETS starts in 2025.

**Table 3**
Average Installation Emissions under the Turkish MRV and EU ETS ($ktCO_2e$)

| | Turkish MRV | | | EU ETS |
|---|---|---|---|---|
| Activity | Category A | Category B | Category C | |
| Non-Ferrous Metals | None | 73.9 | 241.8 | 87.1 |
| Plaster | 23.5 | None | None | 29.8 |
| Aluminum | 23.6 | 49.1 | 637.6 | 145.2 |
| Glass | 30.3 | 178.9 | None | 53.7 |
| Cement | None | 323.7 | 1250.5 | 475.3 |
| Lime | 14.7 | 99.4 | 541.3 | 121.9 |
| Ceramics, Bricks | 10.3 | 92.7 | 268.1 | 19.4 |
| Mineral Wool | 16.9 | 42.2 | None | 43.4 |
| Iron | 17.3 | 98.3 | None | 77.8 |
| Pig Iron-Steel | 8.0 | 208.5 | 4992.0 | 495.9 |
| Electricity | 11.3 | 114.0 | 2374.3 | 154.0 |
| Paper | 19.2 | 105.3 | 370.6 | 33.7 |
| Chemicals | 17.4 | 294.1 | 1129.6 | 139.0 |
| Refinery Products | None | 54.4 | 1890.1 | 1044.5 |

*Source*: Turkish Ministry of Environment, Urbanization and Climate Change; EU ETS data viewer.

The current Turkish MRV system's exclusive focus on Category C installations has resulted in the systematic exclusion of several energy-intensive sectors, including plaster, glass, mineral wool, and iron production, as evidenced in Table 3. A comparative analysis with the EU ETS reveals significant potential for expanding installation coverage within the Turkish framework. For instance, the average emission of plaster production facilities under the EU ETS (29.8 kt $CO_2e$) approximates that of Turkish Category A installations (23.5 kt $CO_2e$). Similar parallels emerge in glass and iron production, where EU ETS averages of 53.7 kt $CO_2e$ and 77.8 kt $CO_2e$, respectively, fall substantially below the emission thresholds for Turkish Category B installations.

This discrepancy suggests that the Turkish MRV system - and by extension, the forthcoming ETS - could achieve more comprehensive sectoral coverage through revised categorization criteria. The EU ETS' activity-specific installation selection methodology (detailed in Table 4) offers a potentially valuable framework for such reforms, particularly in establishing technically appropriate thresholds for additional industrial sectors.

**Table 4**
Categories of Activities to which the ETS Directive Applies

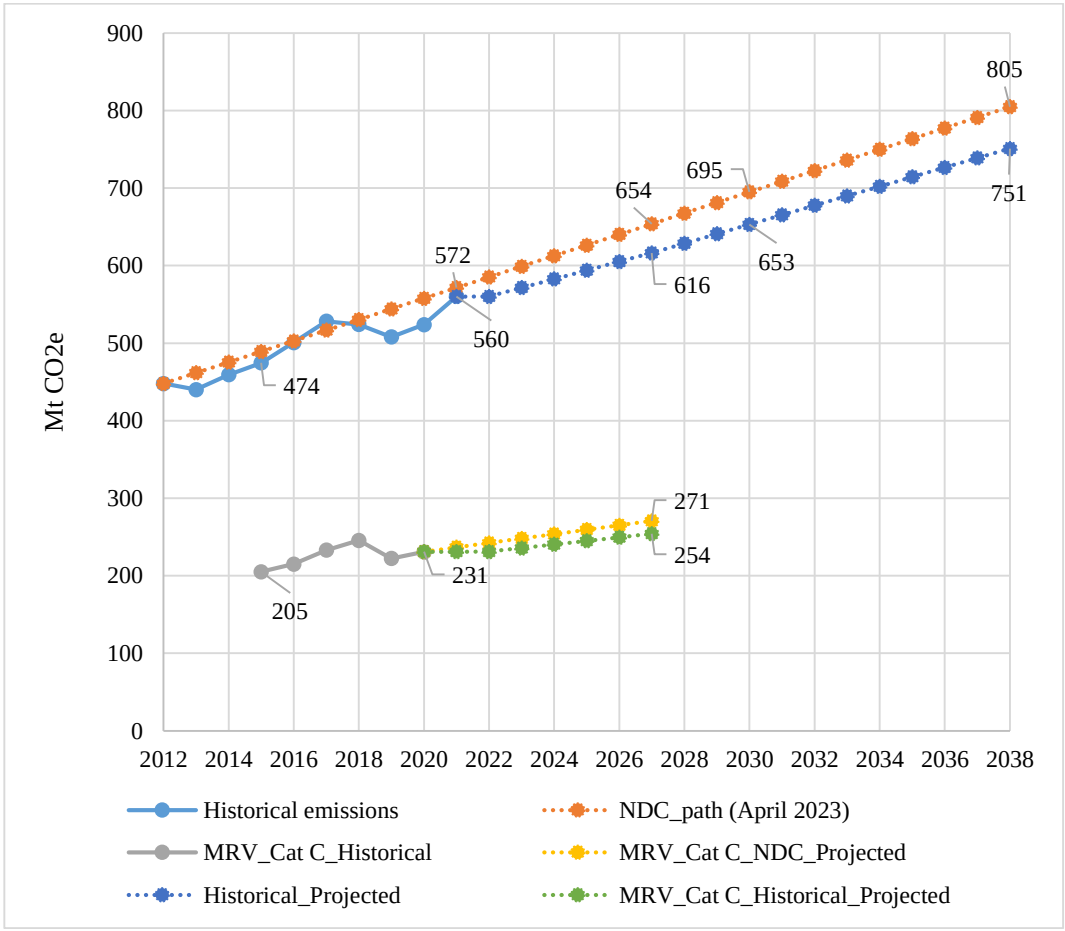
| Activity | Category C-Turkish MRV | EU ETS |
|---|---|---|
| Non-Ferrous Metals | emissions >500 $ktCO_2e$/year | combustion units with a total rated thermal input > 20 MW |
| Plaster | emissions >500 $ktCO_2e$/year | combustion units with a total rated thermal input > 20 MW |
| Aluminum | emissions >500 $ktCO_2e$/year | combustion units with a total rated thermal input > 20 MW |
| Glass | emissions >500 $ktCO_2e$/year | melting capacity >20 tons/day |
| Cement | emissions >500 $ktCO_2e$/year | rotary kilns >500 tons/day; other furnaces >50 tons/day |
| Lime | emissions >500 $ktCO_2e$/year | rotary kilns or other furnaces >50 tons/day |
| Ceramics, Bricks | emissions >500 $ktCO_2e$/year | production capacity >75 tons/day |
| Mineral Wool | emissions >500 $ktCO_2e$/year | melting capacity >20 tons/day |
| Iron | emissions >500 $ktCO_2e$/year | combustion units with a total rated thermal input > 20 MW |
| Pig Iron-Steel | emissions >500 $ktCO_2e$/year | capacity > 2.5 tons/hour |
| Electricity | emissions >500 $ktCO_2e$/year | combustion units with a total rated thermal input > 20 MW |
| Paper | emissions >500 $ktCO_2e$/year | capacity > 20 tons/day |
| Chemicals | emissions >500 $ktCO_2e$/year | carbon black combustion units with a total rated thermal input > 20 MW; etc. |
| Refinery Products | emissions >500 $ktCO_2e$/year | combustion units with a total rated thermal input > 20 MW |

*Source*: Turkish Ministry of Environment, Urbanization and Climate Change, EU ETS Regulatory Guidance for Installations (https://climate.ec.europa.eu/system/files/2016-11/guidance_interpretation_en.pdf )

It was announced that the Turkish MRV will employ a single criterion to determine the scope of installations: that is, installations emitting more than 500 $ktCO_2e$ will be covered under the Turkish ETS. However, the EU ETS has long employed a more detailed set of criteria specifically designed for each activity, as shown in Table 4. Using single emission-based criterion may lead to biased installation selection.

One of the most important elements of ETS is the determination of the cap. The cap sets the upper boundary for permissible GHG emissions within a scheme, essentially determining the total number of allowances (emissions budget) allocated to covered entities. An absolute cap ensures that emissions remain below a specified limit, guaranteeing a predetermined environmental outcome. The pricing of allowances is influenced by factors like the quantity of available allowances under the cap, the ease of emissions reduction for installations, and variables such as consumption patterns and drivers of economic growth. These elements must be considered when formulating a cap. While the carbon price is affected by these factors as well, a generous emissions budget tends to result in a surplus market and a lower allowance price, diminishing incentives for emissions reduction. Conversely, a relatively stringent emissions budget, or a "tight cap," implies a restricted supply of allowances, creating a market shortfall, leading to a higher allowance price, and providing a stronger fiscal motivation for emissions reduction. Hence, determining the cap trajectory accurately is important for an effective functioning of an ETS. Turkish authorities have indicated that the emissions cap under the forthcoming ETS will follow an increasing trajectory aligned with projected emissions growth outlined in the April 2023 NDC. This approach raises significant concerns regarding the stringency of the proposed cap, as it appears to prioritize economic growth objectives over meaningful emission reductions. The decision to implement an expanding rather than contracting cap contrasts with established ETS best practices, where declining caps serve as the primary driver for decarbonization (Ellerman et al., 2010). Such a design risks creating structural oversupply in the carbon market, potentially undermining both price signals and the system's environmental integrity.

**Figure 1**
Historical and Projected GHG Emissions in Türkiye ($MtCO_2e$)




*Source*: Climate Action Tracker; Turkish Ministry of Environment, Urbanization and Climate Change; author's calculation.

Türkiye's Nationally Determined Contribution (NDC) projects national emissions to reach 1,178 Mt $CO_2e$ by 2030 under a Business-as-Usual (BaU) scenario (excluded from Figure 1 for clarity). The commitment to limit emissions to 695 Mt $CO_2e$ by 2030 - representing a 41% reduction from BaU levels - is visually demonstrated in Figure 1. The NDC further indicates an emissions peak in 2038 without specifying the magnitude; however, extrapolating the post-2030 trajectory suggests a projected peak of approximately 805 Mt $CO_2e$.

Contrary to these projections, historical emission trends from 1990-2021 reveal an average annual growth of 11.2 Mt $CO_2e$. Maintaining this trajectory would result in substantially lower emissions of 653 Mt $CO_2e$ by 2030 and 751 Mt $CO_2e$ by 2038 - figures markedly below NDC projections. This divergence between projected and historical pathways underscores the critical importance of evidence-based cap determination for the effective operation of the forthcoming ETS.

Empirical analysis of Türkiye's 2015–2020 emissions data, corresponding to the operational period of its Monitoring, Reporting, and Verification (MRV) system, indicates that Category C installations—those slated for inclusion in the forthcoming ETS—contributed 44.4% of national emissions on average. In 2020, with Türkiye's total emissions at 524 Mt $CO_2e$, Category C facilities accounted for 231 Mt $CO_2e$, establishing a critical benchmark for the ETS's initial cap. Projections suggest divergent trajectories for the cap depending on the adopted emissions pathway:

- *NDC-aligned path*: The cap would rise to 271 Mt $CO_2e$ by 2027 (post-pilot phase), reflecting the government's officially announced trajectory.
- *Historically observed path*: Under a trend-based scenario (see Figure 1, *MRV_CatC_Historical_Projected*), the cap would reach only 254 Mt $CO_2e$ —17 Mt $CO_2e$ lower than the NDC projection (271-254).

This discrepancy implies a tangible oversupply risk: if the NDC-aligned cap is implemented, regulated installations could receive 17 million excess allowances by 2027—unnecessary for compliance given actual emissions trends. Such surplus allocation risks undermining market incentives, as free allowances exceeding real demand could suppress carbon prices and erode the ETS's effectiveness. Note that the oversupply (or surplus) of allowances under the first phase of the EU ETS had driven down the allowance prices near zero in 2008 (Hintermann, 2010). Note also that the oversupply of free allowances may lead to windfall profit for installations earned from selling excess allowances and by passing through carbon costs (that have not been actually incurred) to end consumers. Delft (2021) calculated that industrial companies in the EU ETS earned an additional profit of € 26 to € 46 billion between 2008 and 2019 from cost pass-through in industry.

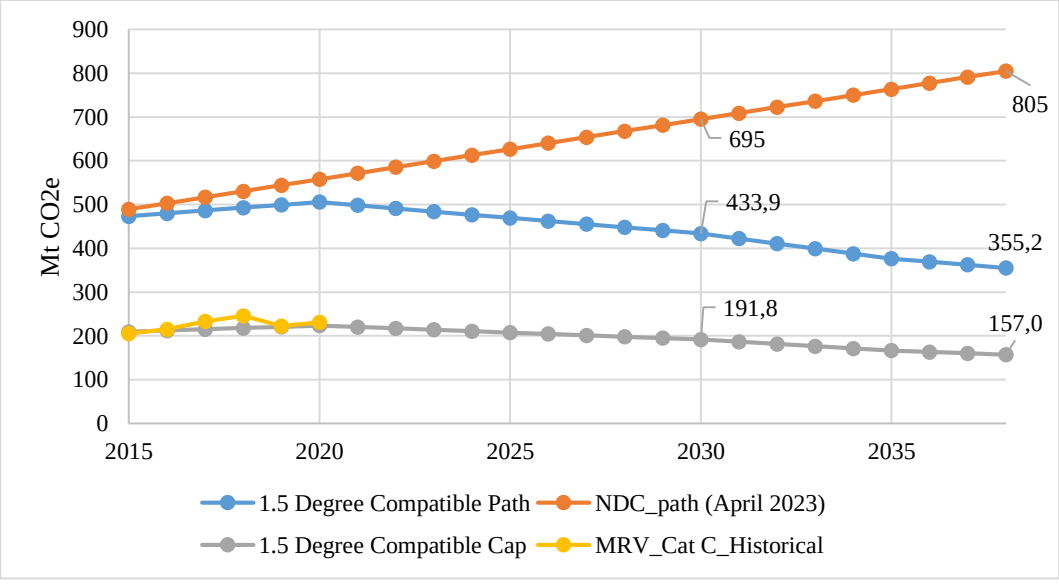
The effective functioning of an emissions trading system (ETS) fundamentally depends on two critical design elements: (1) the establishment of a binding emissions cap that ensures actual emission reductions below business-as-usual levels, and (2) the minimization of freely allocated allowances, both in quantity and duration, to maintain robust carbon price signals. In the Turkish context, the current ETS framework demonstrates significant shortcomings in both dimensions. The system's non-restrictive cap fails to enforce meaningful emission constraints, while the prevailing practice of generous allowance allocation creates

counterproductive incentives that effectively subsidize carbon-intensive facilities rather than driving their decarbonization. These structural deficiencies highlight the urgent need for comprehensive policy reform, particularly through revision of Türkiye's Nationally Determined Contribution (NDC) to establish science-based emission reduction trajectories that align with the nation's 2053 carbon neutrality commitment. The revised NDC should incorporate empirically-grounded projections of greenhouse gas emissions while mandating a progressive tightening of both the ETS cap and the phase-out schedule for free allowances to ensure the system's environmental integrity and effectiveness as a climate policy instrument.

According to the Climate Action Tracker (CAT), an independent scientific project that tracks governments' climate actions, a 1.5-degree compatible and fair emission level in Türkiye is calculated to be 433.9 Mt $CO_2$e in 2030 (as opposed to 695 Mt $CO_2$e announced in the NDC) (CAT, 2023).

Assuming that the MRV Category C installations, those are expected to be covered under the Turkish ETS, would continue to emit on average 44.4% of total emissions, one can find the "1.5-Degree Compatible Cap" for Türkiye as presented in Figure 2.

**Figure 2**
NDC and 1.5-Degree Compatible Paths




*Source*: Climate Action Tracker; Turkish Ministry of Environment, Urbanization and Climate Change; author's calculation.

According to the calculation, the cap should be reduced to 191.8 Mt and to 157 Mt $CO_2e$ in 2030 and 2038, respectively. The absolute reduction in the cap would ensure a positive carbon price in the Turkish ETS market.

The implementation of an ETS presents several significant opportunities for climate mitigation and economic transformation. By establishing a market-based carbon pricing mechanism, an ETS can cost-effectively reduce greenhouse gas emissions by incentivizing businesses to adopt cleaner technologies and improve energy efficiency, while allowing flexibility in how they meet targets. This system generates revenue through allowance auctions that governments can reinvest in renewable energy projects, just transition programs, and climate adaptation measures.

**Table 5**
Domestic ETS Revenues (10 euros per allowance)

| Year | Category C Emissions (Mt $CO_2e$) | Revenue (Bn Euros) |
|---|---|---|
| 2015 | 205 | 2.1 |
| 2016 | 215 | 2.2 |
| 2017 | 233 | 2.3 |
| 2018 | 246 | 2.5 |
| 2019 | 222 | 2.2 |
| 2020 | 231 | 2.3 |

*Source*: Ministry of Environment, Urbanization and Climate Change; Author's calculation.

From the Turkish MRV data, in Table 5, it can be calculated that the revenue that can be generated ranges between 2.1 and 2.5 billion euros annually (assuming a constant allowance price of 10 euros).

These revenues could be strategically allocated to accelerate the country's low-carbon transition while supporting equitable economic development. Priority spending areas should include: (1) financing renewable energy projects and grid modernization to decarbonize the power sector; (2) supporting industrial energy efficiency programs and clean technology adoption in hard-to-abate sectors; (3) establishing a just transition fund for affected workers and communities in carbon-intensive regions; (4) enhancing climate adaptation measures for vulnerable sectors like agriculture and water management; and (5) funding research and development in emerging green technologies such as green hydrogen and carbon capture. To

ensure public acceptance, a transparent revenue management framework should be established, with regular reporting on climate investments. A portion of funds could also be directed to vulnerable households through energy bill assistance or clean energy subsidies to mitigate potential regressive impacts of carbon pricing. By strategically reinvesting ETS revenues, Türkiye could both achieve its climate goals and foster sustainable economic development aligned with its green growth objectives.

## 5. Conclusions

ETS have gained increasing prominence as a market-based mechanism for mitigating GHG emissions. As of 2024, 36 ETS initiatives are operational worldwide, with 22 under consideration and three scheduled for implementation (World Bank, 2025). Among the countries exploring a domestic ETS, Türkiye has advanced its preparatory efforts, with a system expected to take effect in 2026.

Türkiye's journey toward establishing an ETS began in 2015 with the introduction of a MRV system, encompassing key industrial sectors such as electricity generation, refinery products, non-metallic minerals, iron and steel, aluminum, paper, and chemicals—a scope largely mirroring that of the EU ETS, with the notable exception of aviation. However, the inclusion criteria for installations under the Turkish ETS have raised concerns. Current regulations stipulate that only Category C installations emitting over 500 kt $CO_2$/year will be covered, a threshold that—according to historical MRV data—would exclude major emitters in plaster, glass, mineral wool, and iron production. Adopting the EU ETS's activity-specific thresholds could address this limitation by ensuring comprehensive sectoral coverage.

A critical determinant of an ETS's efficacy is the stringency of its emissions cap. Empirical evidence from the EU ETS demonstrates that effective carbon pricing emerges only under conditions of allowance scarcity; an oversupply risks depressing prices to near-zero levels, undermining the system's environmental integrity (Ellerman et al., 2010). Türkiye has yet to finalize its cap but has indicated alignment with its NDC, submitted in April 2023. However, the NDC has faced criticism for its lack of ambition. Notably, Türkiye's actual emissions since 2012 have consistently fallen below NDC projections (except in 2017), and independent assessments—such as those by CAT —classify Türkiye's commitments as insufficient to meet either a 1.5°C or 2°C pathway (CAT, 2023).

Under a "fair share" and 1.5°C-compatible scenario, Türkiye's emissions should not exceed 433.9 Mt $CO_2e$ by 2030, contrasting sharply with the 695 Mt $CO_2e$ projected under its current NDC. Furthermore, if Category C installations

continue to account for 44.4% of national emissions, the sectoral cap must decline from 231 Mt $CO_2e$ in 2020 to 191.8 Mt $CO_2e$ by 2030 to prevent market distortions. Failure to adjust the cap accordingly risks generating an allowance surplus of at least 17 million units by 2027, which could collapse carbon prices and inadvertently grant windfall profits to high-emitting industries.

Analysis of Turkish MRV data (Table 5) indicates potential annual ETS revenues of €2.1–2.5 billion (at €10/allowance), which could strategically accelerate decarbonization if allocated to: (1) renewable energy deployment, (2) industrial efficiency programs, (3) just transition mechanisms, (4) climate adaptation, and (5) green R&D. Revenues from Türkiye's Emissions Trading System (ETS) could support vulnerable households and small firms affected by carbon pricing through targeted measures such as direct financial assistance (e.g., energy bill subsidies or cash transfers for low-income families), green transition programs (e.g., funding for energy-efficient retrofits, renewable energy adoption, and reskilling initiatives for workers in carbon-intensive sectors), and support for small businesses (e.g., grants or low-interest loans to help SMEs shift to cleaner technologies). By reinvesting ETS revenues into these socially equitable solutions—rather than general budgets—Türkiye could mitigate the regressive impacts of carbon pricing, ensure a just transition, and foster broader public acceptance of climate policies. For instance, allocating even a portion of the estimated €2–2.5 billion in annual ETS revenues could fund energy efficiency upgrades for hundreds of thousands of households or provide transitional support for affected industries, aligning decarbonization goals with economic and social resilience.

Effective implementation requires a transparent governance framework with public accountability measures, including targeted household subsidies to offset regressive distributional effects. Such revenue recycling would simultaneously advance Türkiye's climate targets and equitable green growth objectives. This approach aligns with international best practices for maximizing the co-benefits of carbon pricing while maintaining socioeconomic equity.

While an ETS is a pivotal instrument for decarbonization, its success hinges on policy coherence. Complementary measures—such as renewable energy incentives—can enhance its effectiveness, whereas countervailing policies, including fossil fuel subsidies and sectoral tax exemptions, may undermine its impact. Türkiye's existing industrial subsidies and energy pricing policies risk creating such counterproductive effects, necessitating reforms to ensure the ETS drives meaningful emission reductions.

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# Özet

## Türkiye'nin emisyon ticaret sistemi için optimal tasarım: AB'den ve küresel en iyi uygulamalardan çıkarımlar

Bu çalışma, Türkiye Emisyon Ticaret Sistemi'ni (ETS) kurabilmenin zorluklarını ve fırsatlarını, Avrupa Yeşil Mutabakatı (AYM) ve bunun Karbon Sınır Düzenleme Mekanizması (CBAM) kapsamında küresel ETS uygulamalarını (özellikle AB ETS'yi) inceleyerek analiz etmeyi ve Türk sistemindeki olası eksiklikleri ortaya koymayı amaçlamaktadır.

Türkiye'nin 2015'te İzleme, Raporlama ve Doğrulama (MRV) çerçevesiyle başlattığı ETS geliştirme süreci, etkinliğini baltayabilecek kritik tasarım sorunlarıyla karşı karşıyadır. Mevcut 500 kt $CO_2$/yıl C Kategorisi tesis dahil etme eşiği, önemli sektörlerdeki büyük emisyon kaynaklarını sistem dışında bırakma riski taşımaktadır. Bu sınırlama, AB ETS'nin faaliyet bazlı kriterlerinin benimsenmesiyle aşılabilir. Ayrıca, Türkiye'nin önerdiği üst sınır, 2023 Ulusal Katkı Beyanı (NDC) ile uyumlu olsa da, bağımsız analizler bunun Paris Anlaşması'na uyum için yetersiz olduğunu ve 2030 emisyon seviyesinin (695 $MtCO_2e$), 1,5°C ile uyumlu 'adil pay'ın (433,9 $MtCO_2e$) çok üzerinde olacağını göstermektedir. Sıkı düzenlemeler yapılmazsa, TR ETS 2027'de hayata geçtiğinde 17 milyon birimlik karbon tahsisat fazlası yaratabilir, bu da karbon fiyatlarını çökerterek yüksek emisyon salıcılarına beklenmedik kazançlar sağlayabilir. Ancak, ETS gelirlerinin stratejik dağıtımı (€10/tahsisat fiyatıyla yıllık €2,1–2,5 milyar), yenilenebilir enerji yatırımları, endüstriyel verimlilik programları ve adil dönüşüm mekanizmalarıyla, tamamlayıcı politikalar mevcut fosil yakıt sübvansiyonlarını ele alır ve politika tutarlılığını sağlarsa, dekarbonizasyonu hızlandırabilir.

Analiz, iklim hedefleriyle uyumlu katı ve azalan bir üst sınırın önemini ortaya koymuş, Türkiye'nin mevcut NDC projeksiyonlarını tarihsel emisyon eğilimleri ve 1,5°C uyumlu senaryolarla karşılaştırmıştır. Son olarak, Türkiye ETS'den elde edilebilecek potansiyel gelirleri tartışıyor ve sürdürülebilir bir ekonomik dönüşüm için bu kaynakların stratejik yeniden yatırımını öneriyoruz.

*Anahtar kelimeler:* Avrupa yeşil mutabakatı, Sınırda karbon düzenleme mekanizması, Türkiye emisyon ticaret sistemi.

*JEL kodları:* D57; C67; Q56.