Assessing Policy Options for Effective Greenhouse Gas Emission Reduction in Turkey: A Comparative Analysis

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# 1. Executive Summary:

This paper examines three policy options to reduce greenhouse gas (GHG) emissions in Turkey: implementation of carbon pricing, “Command-and-control” regulation and “Green Finance”. The main findings reveal that lack of carbon pricing and large subsidy programs are the main driver of GHG emissions in Turkey, making compliance with emission targets set in the Paris Agreement unattainable with current emission trends. Furthermore, “Command-and-control” for emission reduction by technology mandates and/or performance standards is not as effective as the implementation of carbon pricing; due to lack of incentives, centralized information/information asymmetry and infeasibility of tailoring specific requirements to a heterogeneous firm basis. Although the most politically feasible and least regressive, “Green Finance” is the least effective policy in the short-run, and it is incompatible with the urgency of the need for decelerating emission trends in Turkey. Hence, with transparency and proper adjustment, carbon pricing is the most effective policy, suitable for the impending danger of climate change, and to spearhead the transition to a green economy as swiftly as possible.

# 2. Introduction:

Climate change, closely linked with greenhouse gas (GHG) emissions, is a pivotal concern for many economies. Climate change has sparked a vast field of academic debate, endangered the world’s ecosystem, threatened the healthy existence of the global population, and surfaced the need for a complete restructuring of the global economy. The impending harm that climate change and global warming will cause is a concern for many countries and has led to various conventions/agreements between countries such as: United Nations Framework Convention on Climate Change (1992), Kyoto Protocol (1997) and Paris Agreement (2015). The latest convention, Paris Agreement (2015), was adopted by 196 parties and aims to “[...] limit global warming to 1.5℃, greenhouse gas emissions must peak before 2025 at the latest and decline by 2030” (United Nations Framework Convention on Climate Change, n.d.). Turkey has ratified the Paris Agreement in 2021, with a delay of six years, and has submitted an updated version of Nationally Determined Contribution (NDC) in April 2023. In the report, Turkish authorities have pledged to reduce its GHG emissions by 41% in 2030 projections, aiming to peak its emissions in 2038 latest (UNFCCC, 2023). Yet Turkey’s concerning emission trend, which more than doubled in CO2 equivalent compared with 1990, indicates lack of commitment, as noted by Climate Action Tracker as “Critically Insufficient” level of commitment in 2023 (Climate Action Tracker, n.d.). The lack of commitment by Turkish authorities raises possible policy solutions that can be implemented, due to lack of carbon market restructuring in Turkish markets. **How can Turkish authorities fully commit to Nationally Determined Contribution (NDC) goals set by the Paris Agreement, and reduce GHG emissions effectively?**

First the contemporary situation in Turkey; its challenges, existing policies, and how Turkish authorities' commitment to reduce GHG emissions are realized will be explored. Then four policies will be considered: (1) implementing pricing instruments for carbon in the Turkish economy, (2) command-and-control policies in forms of efficiency/technology standards, (3) Green Finance, and (4) maintaining the status quo. The following section will propose a policy recommendation for policymakers.

# 3. Background:

Turkey experienced relatively consistent growth between 1965-2015, averaging 2.795% per year - whereas OECD average for the same period was 2.089% (Karasoy, 2019, p.1). Although a robust average compared with the OECD growth average, this successful growth rate was achieved at the expense of necessary environmental regulation and commitment to climate change goals (Karasoy, 2019, p.1). Turkey has a high trade deficit due to its high dependency on non-renewable foreign energy (Karasoy, 2019). As Figure 1 demonstrates, fossil fuel dependency on energy demand by proportion to total energy demand stayed between 80% - 90%, even demonstrating growth between the years of 1990-2018 (Climate Action Tracker, n.d.). Whereas apart from China (following a similar trend as Turkey), other countries and the European Union have consistently reduced their fossil fuel dependence over the same period (Climate Action Tracker, n.d.).

A graph showing the growth of energy

Description automatically generatedThe economic growth is tied to growing non-renewable energy demand, as noted by Karasoy (2019), where Turkey experienced annual primary energy growth of 2.627% over the period of 1965-2015 - whereas OECD countries averaged around 0.585% (Karasoy, 2019). Due to Turkey lacking fossil fuel reserves and underinvested in renewable energy reserves, this demand was met by mainly non-renewable fossil fuel imports, around 70% (Karasoy, 2019). This trend of growth was at the expense of environmental standards, and according to OECD statistics database, emissions between the period of 1990-2021 showcased dramatic and consistent growth in GHG emissions (OECD, n.d.).

A graph with a line graph and text

Description automatically generatedFigure 2 highlights the development of GHG emissions, which has almost tripled in the past 30 years, where projections made by European Bank for Reconstruction and Development (EBRD) (2011) stating that: “If the Turkish economy grew at a rate of around 4 percent annually over the period 2010- 2030, but remained stuck at its current carbon intensity, its emissions would rise from 367 Mt CO2e in 2008 to 590 Mt CO2e in 2020 and 852 Mt CO2e in 2030” (EBRD, 2011, p.16). Yet, European Bank for Reconstruction and Development’s (EBRD) projections made in 2011 for 2020 emissions - 594 Mt CO2e was realized by 88.8%, at the level of 524 Mt CO2e, indicating the contemporary emission policies are not strict to match the stringency of the Paris Agreement. In addition, Figure 2 further demonstrates three different policies: 1.5 °C Scenario for 2030 calculated by Climate Action Tracker - 300 Mt CO2e - which is in line with the goal of the Paris Agreement, Turkey’s NDC emission target for 2030 - 695 Mt CO2e - as disclosed in Turkey’s NDC statement (UNFCCC, 2023), and with no change in current policies - 1175 Mt CO2e (UNFCCC, 2023). The data actively points at the lack of policy commitment from the Turkish authorities, and with the current policy scenario – Turkey **will not be able to commit** to the goals of Paris Agreement.

As with the emission trends in Figure 2, Turkey is significantly behind to decouple economic growth from GHG emissions. The data from Our World in Data (2023) also showcases that Turkey’s growth in GDP per capita is positively correlated with GHG emissions, and Turkey fails to “decouple” emissions from GDP growth, as demonstrated in Figure 3 (Our World in Data, 2023).

A graph of the growth of gdp per capita and emission

Description automatically generated

Turkey’s inability to decouple economic growth from emissions can be attributed to several reasons. One of the pivotal reasons is that Turkey has not implemented a price mechanism for carbon - no significant implicit/explicit carbon pricing is present, only tax present is in the form of fuel excise taxes (OECD, 2022). This impact can be seen on effective carbon rate data. Net effective carbon rates are a measure for how well regulatory bodies are pricing emissions over time. The higher the net effective carbon rates, emissions are better regulated/priced in that region. OECD (2021) highlights the importance of effective carbon rates, finding an increase in the effective carbon rate by 1 EUR per ton CO2 emitted can lead to 0.79% reduction in emissions in the long run (OECD, 2021, p.3). The lack of price adjustment to carbon in the Turkish economy, results in Turkey's net effective carbon rate to be very low compared to other countries, as demonstrated by data, indicating lax carbon pricing. The data from OECD database of Net Effective Carbon Rates, as interpreted in Figure 4, demonstrates Turkey’s low effective carbon rate compared with G20 average and average of OECD countries (OECD, 2022).

A graph with different colored bars

Description automatically generatedFurthermore, due to lack of carbon pricing measures, Turkey positions well behind when compared to the European Union in terms of Net Effective carbon rates – as demonstrated by Figure 5 below.

A map of europe with different colored areas

Description automatically generated

A map of europe with different colored countries/regions

Description automatically generatedIn addition to lack of carbon pricing, poor environmental regulation, the economy relying on mainly importation of non-renewable energy sources; Turkish authorities are also implementing large subsidy programs for non-renewable energy sources - especially on imported coal. According to the findings of EBRD (2011), Turkish fossil fuel markets consists of various schemes of subsidization, such as:

* Free lignite to poor households.
* Support to domestic hard coal mining, noted as substantial.
* Cross-subsidy for electricity, producers paying more than consumers for transmission and distribution costs (EBRD, 2011, p.21).

For example, Global Subsidies Initiative (2015) finds that total subsidies to the coal industry for mining can be quantified/estimated to be around $ 730 Million alone in 2013 (International Institute for Sustainable Development, 2015, p. iv). In addition, the report also finds that de-facto subsidies in the form of exemptions from environmental standards are also substantial, with a substantial portion of coal-fired power plants not meeting domestic/EU standards as of 2015 (International Institute for Sustainable Development, 2015, p. 9). Due to policies implemented by Turkish authorities leaning on competitive and cheap energy, regardless of its basis, coal subsidization compared to Europe indicate a significant reliance on coal subsidization. As can be noted in Figure 6, subsidy amounts per US dollar is way higher compared to the European continent – indicating mass-subsidization policies still active as of 2021 (OECD, 2022).

# 4. Policy Solutions:

**4.1 Carbon Price Instruments:**

According to the World Bank, carbon pricing can be defined as a mechanism aimed at incorporating the external expenses associated with GHG emissions (World Bank, n.d.). These expenses, which the public typically bears, include various costs like agricultural losses, healthcare expenses due to extreme weather events and pollution, and property damage due to floods and storms (World Bank, n.d.). Carbon pricing links mentioned costs to their origins by imposing a fee, typically in the form of a charge per emitted CO2 (World Bank, n.d.). Carbon pricing is a very effective policy to reduce emissions. Carbon pricing reduces emissions by shifting demand by increasing the cost of carbon-intensive energy and making low-carbon/zero-carbon energy alternatives more competitive. Carbon pricing instruments consists of:

* Emissions taxes / Carbon tax
* Tradable emissions allowances (“Cap-and-trade) - Emissions trading mechanism
* Subsidies for emissions reductions

With current projections, carbon pricing of 120 EUR per ton CO2 emitted is necessary as of 2030 to achieve decarbonization by 2050 (OECD, 2021, p.4). Although Turkish authorities are pledging to reach net carbon-zero by 2053, lack of effective carbon pricing is a substantial contradiction to pledged goals and showcases the need for immediate acceleration of Turkish market restructuring. Considering the Turkish energy sector’s reliance on coal - noted by subsidy programs mentioned, and the harm caused by coal combustion is a primary concern for the carbon reform. According to a report published by the IMF (2023), climate damage due to combustion of coal is substantial - averaging around 60-200 percent of supply costs (IMF, 2023, p.15-16). For the case of coal, local pollution concerns are also substantial. For nations like Turkey, consisting of economies mainly relying on fossil fuels and non-renewable sources of energy, adopting carbon pricing is crucial to meet climate goals and mitigate fossil fuel harms.

One of the major downsides of carbon pricing is its regressive impact to households with low-middle income levels. Because low-income households “tend to spend larger shares of their budgets on electricity, home heating fuels, gasoline, and other energy-intensive goods” (Goulder & Parry, 2008, p.165). Also, the potential for revenue generation from higher carbon pricing can be a strong upside as well as a strong downside. The benefit of revenue generated depends on how the funds are spent/reallocated, and if the revenues raised are recycled to benefit the average consumer - due to consumers receiving the full brunt of the price increase.

One of the other shortcomings of carbon pricing is the competitiveness concerns in production, labor, and export. For example, according to Goulder & Parry (2008), due to pricing instruments shifting the impact from the price increase of carbon-intensive energy, the consumer price level will rise - resulting in a loss in real factor returns. (Goulder & Parry, 2008, p.161). This will result in the phenomenon as termed as the “Tax-interaction effect”, due to depression in factor supply, and subsequent efficiency loss. “Tax-interaction effect” will increase the costs of environmental policies due to efficiency loss. (Goulder & Parry, 2008, p.161). As noted by Aydın (2018), “[...] a reduction of 5.75% in carbon emissions via carbon tax with $7 per ton of emission cuts back the real GDP by 0.061 [...] 12.02% reduction in carbon emissions via carbon tax, with %20 per ton of emission, lowers the real GDP by 0.181 and per capita utility from household expenditure by 0.186” (Aydın, 2018, p.794-795). Aydın (2018) further finds that “Turkey’s coal sector would be hit the hardest by any carbon tax implantation with output declining by 49% in the $20 per ton of carbon scenario, followed by the gas production and gas distribution sectors” (Aydın, 2018, p.795).

In the context of nations like Turkey, where fossil fuel reliance poses significant challenges, implementing carbon pricing is a potent policy to align with global climate objectives.

**4.2 “Command-and-Control” Approach**

Carbon pricing is difficult to implement due its political nature. Due to concerns of price increases in energy consumption reflecting on the consumer-end channel, governments often opt-for non-pricing instruments due to their avoidance in energy prices. (IMF, 2023, p.6). Performance standards and technology mandates are often popular policy instruments for the “Command-and-Control” approach.

**4.2.1 Technology Mandates**

However, according to (Goulder & Parry, 2008, p.157), direct regulations like technology mandates and performance standards face challenges compared to emissions taxes and tradable emissions allowances. These challenges stem from asymmetric information and instruments’ limitations in effectively utilizing cost-minimizing channels for reducing emissions (Goulder & Parry, 2008, p.157). Due to the heterogeneity of firms, a regulator might not possess adequate information “to set standards that maximize cost-effectiveness” across firms. If a single mandate with a myopic criterion (lacking complete current information and future costs) applied to a pool of heterogeneous firms, firms might face different costs to meet the mandate. Moreover, due to “command-and-control” approach requiring extensive processing of information and constant monitoring, setting an “efficient” fuel price might not consider complicated and out of scope market failures such as - spillovers from learning-by-doing for firms or free-riding on other firms’ R&D, further amplifying asymmetric costs can be faced by firms (IMF, 2023, p.6). Although lower per-unit output prices might seem like an advantage, due to input channels for firms being unaffected (lack of carbon pricing assumed) - the firms might not be incentivized properly to switch to low carbon-intensive inputs for production.

**4.2.2 Performance Standards**

Unlike technology mandates, which impose requirements of a firm’s production process to be met, performance standards require a firm’s output to meet a specific set of conditions. These can be noted as:

* Fuel standards for transport.
* Building energy efficiency
* Product energy efficiency
* Emission rate cap on per kilowatt-hour of electricity used.

Performance standards have the advantage of flexibility from the firm’s side, as noted by Goulder and Parry (2008), and are better when it comes to cost-effectiveness compared with technology mandates (Goulder & Parry, 2008, p.161). Yet, performance standards also require regulatory bodies to possess extensive market information on costs, monitoring on emissions and compliance tracking. It is difficult to tailor needs of a specific firm that has different characteristics - across different sectors. Yet compared to mandating general technology standards, cost of information and monitoring can be mitigated by employing a standard-permit/credit scheme, allowing firms to trade permits and hence allocate investments more effectively. Hence performance standards possess better flexibility due to better utilization of market information and dispersion compared with centralized technology mandates.

**4.3 “Green Finance” - Restructuring the Financial Sector**

Green finance is a new financial channel to integrate climate mitigation and enhance environmental protection without neglecting economic profits. Green finance utilizes a market-oriented mechanism with utilization of various financial products that can mitigate emissions (Wang & Zhi, 2016). One of the financial market mechanisms utilized by regulatory entities was the emission trading system, by the cooperation of the Slovak and Japanese government - initiating a global emissions trade market in 2002 (Wang & Zhi, 2016, p.312). Some of the types of green financial products noted by the study (2016) are:

* Environmental and biodiversity funds
* Nature-linked securities
* Green investment funds
* Carbon market tools

The United Nations Framework Convention on Climate Change mandates nations to undertake environmentally friendly initiatives aimed at combating climate change and reducing pollution. Transitioning to a sustainable economy is crucial in the fight against climate change. Governments can tackle inadequate funding and investment in eco-friendly or efficient industries without affecting consumer prices, by utilizing "green finance". This term refers to the financial industry working in conjunction with governments to leverage effective financial instruments for raising capital for future environmentally friendly investments.

In addition to the prospect of raising funds for governments, green finance can also be an indirect performance/technology standard. Without the direct approach of “command-and-control”, green finance in the long run might incentivize (to the point of mandating by market forces) to invest in more efficient and eco-friendly technologies, lacking the regressive element of carbon pricing.

Turkish authorities have already been implementing financial reforms that fall under the category of green finance. According to disclosed information on the official website of Borsa Istanbul (n.d.), the financial equivalent of the Wall Street for the largest Turkish companies, has signed a cooperation agreement with external auditors (Refinitiv Information Limited) to access Borsa Istanbul listed companies - to be evaluated under international sustainability criteria. Borsa Istanbul has implemented BIST Sustainability Indices - in accordance with external assessments (Borsa İstanbul, n.d.).

# 5. Policy Recommendation

**5.1 Effectiveness**

Due to the necessity of immediate action to decelerate GHG emissions, the most effective policy to be implemented, necessitated by the emergency of the adverse impact of climate change, is carbon pricing. As showcased by OECD (2021), a country with no existing carbon pricing; an increase of 10 EUR per ton of CO2 emissions, when applied to the whole energy base, will reduce emissions by an estimated amount of 7.3% (OECD, 2021). A notable case, as provided by the report (2021), is with the implementation of strict carbon pricing to the electricity sector of the UK. Due to implementation of carbon pricing, increasing the effective carbon rate in the electricity sector from 7 EUR per ton of CO2 in 2012 to 36 EUR per ton of CO2 in 2018, emissions in the electricity sector dropped by 73% in the span of six years. The example with the UK also highlights the potential for the Turkish economy when it comes to increasing the average effective carbon rate, since the Turkish energy base is lacking explicit carbon pricing. Due to lack of carbon pricing, the effectiveness of green finance is also compromised. According to Oil Change International’s report (2015) cited in Karasoy’s (2019) study, higher subsidies to non-renewable sources discourage the investment in renewable energy sources. (Karasoy, 2019, p.9229). Considering the high amount of coal subsidization programs implemented in the Turkish energy sector, especially for coal, cessation of subsidization for non-renewable resources with implementation of efficient carbon pricing is pivotal for reducing GHG emissions.

“Command-and-control” approach in the form of technology mandates and performance standards, are less efficient compared to emission pricing. The reason is that, according to Goulder and Parry (2008), firms are not completely charged for all their emissions - instead over-focusing on reducing emission-intensity rather than input-substitution of environment-friendly resources (Goulder & Parry, 2008). Lack of incentives for input substitution render “command-and-control” approach less effective compared to carbon pricing. Turkish regulatory authorities are already implementing policies that fall under the criteria of “command-and-control” approach. According to the National Energy Efficiency Action Plan (NEEAP) report (2017) for the period of 2017-2023, the authorities deem it necessary to impose energy efficiency obligations on energy (electricity, natural gas, petroleum - coal not mentioned) (Turkish Ministry of Energy and Natural Resources, 2017). In case of under-compliance, the firms are expected to make contributions proportional to their compliance gap. Funds raised will be reallocated to support energy efficiency measures (Turkish Ministry of Energy and Natural Resources, 2017, p.32). Yet it is worth noting that the plan also mentions: “The current best technologies and practices will be determined for Turkey and sectoral best practice guides will be published” (Turkish Ministry of Energy and Natural Resources, 2017). In a different section of the plan, it has been stated that: “Necessary resources will be allocated if economically and technically feasible. Monitoring, verification, and awareness-raising activities will be carried out” (Turkish Ministry of Energy and Natural Resources, 2017, p.73). As noted, the plan’s reliance on central monitoring is notable, and is not exempt to the downsides of the command-and-control approach already discussed. Feasibility, cost-effectiveness, emissions targets to be determined by a central authority lacks cost-minimization of companies (that reflects information in price and investment) and does not consider specific needs of heterogeneous companies.

The green finance approach in general, due to investments’ long-term nature, is not an immediate solution to mitigate the increasing trend of emissions in Turkey. Current approach of the Turkish financial industry - to create a sustainability index relies on an external resource for monitoring and processing information - which according to Borsa Istanbul’s statement, will be covered by Borsa Istanbul. According to Goulder and Parry (2008), lack of information on the consumer side can cause distortions in consumer perception - leading to undervalue (or overvalue) improvements in energy-efficiency (Goulder & Parry, 2008) Such under/overvaluation in the finance industry can arise due to information asymmetries, which is usually present when the markets are not perfectly competitive. Not perfect competitive markets can increase administrative costs, reduce consumer surplus, and render immediate action with green finance as the backbone of a climate change mitigation policy ineffective compared to efficient carbon pricing. Although politically feasible and the least regressive, the indirect and long-term approach renders this approach incompatible for future policymakers to prioritize. Yet the expanding industry of green finance is still important for transitioning to a green economy in the long run.

**5.2 Political Feasibility**

The main challenge that must be tackled while implementing an effective carbon pricing policy is political infeasibility. Due to the increase in price of consumer goods, carbon pricing has the biggest disadvantage - lack of support from the citizen basis, which determines the directions of policies to be implemented by political support. The mentioned challenge is an information problem in essence, due to the asymmetric nature of information between bureaucratic/regulatory bodies undermining trust. Yet, as showcased by the example of British Columbia’s carbon tax by OECD (2013), this example showcased the importance of communication between regulatory entities and citizens (OECD, 2013, p.48). According to OECD (2013), The carbon tax imposed was revenue-neutral, meaning that all the revenue generated was eventually returned to the public as tax cuts and rebates (OECD, 2013). To ensure that the carbon tax is revenue neutral, the government provided a transparent plan to the legislature each year - in a sense reducing asymmetric information and building trust. In the end, as a showcase of trust, the political party retained support. This example demonstrates that political infeasibility can be traced to lack of transparency, which can be mitigated with relatively low cost - compared to other policies.

**5.3 International Competitiveness**

According to OECD (2013), without a worldwide emissions trading scheme in place, companies facing carbon pricing could find themselves at a disadvantage compared to those without such costs (OECD, 2013, p.42). This could lead to industries affected by climate policies relocating production to countries without such regulations, thus reducing employment opportunities and economic output in the enforcing country (OECD, 2013, p.42). Alternatively, they might lose market share to competitors not subject to carbon pricing. Moreover, the uneven implementation of climate policies can result in carbon leakage, where emissions increase in non-compliant countries due to actions taken by compliant ones (OECD, 2013, p.46). Yet, a potential solution to address competitiveness concerns and promote international cooperation involves providing indirect subsidies to vulnerable companies. This approach can provide substantial support for companies in complying with climate policies while maintaining their competitiveness in global markets.

**5.4 Final Recommendation**

Hence, addressing Turkey's emissions challenges requires urgent and decisive action. Turkey’s delayed ratification of the Paris Agreement and concerning emissions trends necessitate an effective policy solution to reduce GHG emissions. Carbon pricing emerges as a potent tool for mitigating emissions, with the potential to significantly reduce GHG emissions while promoting market efficiency. However, its implementation may face political resistance and competitiveness concerns, necessitating careful consideration and communication strategies to ensure public support and international competitiveness. In addressing Turkey's emissions challenges, policymakers must prioritize the implementation of effective carbon pricing mechanisms. Yet, due to sudden shock concerns and regressive impact on energy prices – Turkish authorities must transition to an active carbon pricing strategy gradually. Turkish authorities should aim for pushing the net effective carbon rate above the OECD average value of approximately 40 € feasibly and aim for a net effective carbon rate of 60 € + until 2030. This implies that subsidies to coal must be discontinued, investments in coal plants must be reduced and carbon pricing must be introduced to the Turkish economy. Carbon pricing offers a clear pathway to reducing emissions while incentivizing market efficiency and innovation. By adopting a comprehensive carbon pricing strategy and leveraging international cooperation, Turkey can work towards fulfilling its climate commitments and contributing to global efforts to combat climate change.

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# Appendix

*Table 1: Policy Comparison*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Effectiveness** | **Political Feasibility** | **International Competitiveness** | **Regressive Impact (+ = Yes)** |
| **Do Nothing** | - | + | + | - |
| **Carbon Pricing** | + | - | +/- | + |
| **Command-and-Control** | - | + | +/- | - |
| **Green Finance** | - | + | +/- | - |