THE IMPACT OF
THE CARBON BORDER ADJUSTMENT MECHANISM (CBAM)
ON STEEL PRODUCERS' DEMAND FOR AND ATTITUDES TOWARD
RENEWABLE ENERGY IN TURKIYE

GRADUATE SCHOOL OF SOCIAL SCIENCES

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AYLİN İNGENÇ EKER

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

Prof. Serdar SAYAN
Dean of the Graduate
School of Social Sciences

This is to certify that I have read this thesis and that it in my opinion is fully adequate, in scope and quality, as a thesis for the Degree of Master of Sciences in the field of Economics at the Graduate School of Social Sciences.

Thesis Advisor
Prof. Serdar SAYAN
(TOBB ETU, Economics)

Asst. Prof. Shihomi ARA AKSOY
(Hacettepe University, Economics)

Thesis Committee Members
Assoc. Prof. Pınar DERİN GÜRE
(METU, Economics)

Asst. Prof. Belgi TURAN
(TOBB ETU, Economics)

Asst. Prof. Onur YENİ
(Hacettepe University, International Economics)

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Aylin İNGENÇ EKER

ABSTRACT

THE IMPACT OF

THE CARBON BORDER ADJUSTMENT MECHANISM (CBAM)

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RENEWABLE ENERGY IN TURKIYE

EKER İNGENÇ, Aylin
Master of Science, Economics
Supervisors:
Asst. Prof. Shihomi ARA AKSOY
Prof. Serdar SAYAN

Undesirable effects of climate crisis become more visible every day, making it necessary to design policies to tackle them. One of the most critical steps to take in the right direction is promotion of switches to renewable energy sources so as to reduce carbon dioxide (CO_2) emissions released into the atmosphere by manufacturing plants. The European Union's Carbon Border Adjustment Mechanism (CBAM) aims to reduce these carbon emissions by placing a surcharge on imported goods based on their carbon footprint. This thesis investigates possible effects of CBAM on steel producers' demand for, and attitudes toward renewable energy in Turkiye. For this purpose, a survey-based discrete choice experiment (DCE) is conducted to determine Turkish steel producers' marginal willingness to pay (MWTP) for renewable energy under alternative scenarios. Findings from the experiment indicate that the longer the duration of government guarantees to keep renewable energy prices constant, the more attractive the transition to renewable energy is. The survey responses also show that steel producers value renewable energy intrinsically more than its actual price. In addition, steel producers responding to the survey prefer that fixed and specific usage fees be employed during the transition to renewable energy. Based on these findings the thesis discusses the role that the Turkish government could potentially play in facilitating this transition, reducing steel producers' carbon footprint, and promoting renewable energy supply.

Keywords: Renewable Energy, Carbon Border Adjustment Mechanism, Discrete Choice Experiment, MWTP, Mixed Logit Model

ÖZ

“SINIRDA KARBON DÜZENLEME MEKANİZMASI”NIN TÜRKİYE’DEKİ ÇELİK ÜRETİCİLERİNİN YENİLENEBİLİR ENERJİYE YÖNELİK, TALEP VE DAVRANIŞLARINA ETKİSİ

EKER İNGENÇ, Aylin
Yüksek Lisans, İktisat
Tez Danışmanları:
Dr. Öğr. Üyesi Shihomi ARA AKSOY
Prof. Dr. Serdar SAYAN

İklim krizinin yıkıcı etkileri her geçen gün daha görünür hale gelirken, bunların önlenmesi için politikalar tasarlama gereği de daha güçlü biçimde hissedilmektedir. Söz konusu etkileri önlemenin en kritik adımlardan biri, imalat sanayi kaynaklı atmosfere salınan karbondioksit (CO_2) emisyonları azaltmak için yenilenebilir enerji kaynaklarına geçişi teşvik etmektir. Avrupa Birliği'nin Sınırda Karbon Düzenleme Mekanizması (CBAM), ithal edilen mallara karbon ayak izlerine göre bir ek ücret koyarak karbon emisyonlarını azaltmayı amaçlamaktadır. Bu tez, CBAM'in Türkiye'deki çelik üreticilerinin yenilenebilir enerji talebi ve davranışları üzerindeki etkilerini incelemektedir. Bu amaçla Türk çelik üreticilerinin yenilenebilir enerji kaynakları için marjinal ödeme istekliliğini (MWTP) ve yenilenebilir enerjiye geçiş sürecinde kullanılacak ekonomik enstrümanlara yönelik tercihlerini belirlemek için ayrık bir seçim deneyi kurgulanmış ve anket yoluyla gerçekleştirilmiştir. Bulgular, devletin sağlayacağı yenilenebilir enerji fiyat garanti süresi ne kadar uzunsa, çelik üreticilerinin yenilenebilir enerjiye geçişini o kadar cazip kıldığını göstermektedir. Ayrıca bulgular katılımcıların yenilenebilir enerjiye mevcut fiyatından daha fazla değer verdiğini ortaya koymaktadır. Bunun yanı sıra katılımcı çelik üreticileri yenilenebilir enerjiye geçişte sabit ve belirli kullanım ücretlerini tercih etmektedir. Tezde bu bulgular ışığında, Türk hükümetinin bu geçişi kolaylaştırma, çelik üreticilerinin karbon ayak izini azaltma ve yenilenebilir enerji arzını teşvik etme konusunda atabileceği adımlar da tartışılmaktadır.

Anahtar Kelimeler: Yenilenebilir Enerji, Sınırda Karbon Mekanizması, Ayrık Seçim Deneyi, Ödeme İstekliliği, Karma Logit Modeli.

To my dearest elder sister Aslı.

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LIST OF ABBREVIATIONS

AGE : Applied General Equilibrium Model
AR6 : Sixth Assessment Report
BOF : Basic Oxygen Furnace
CBAM : Carbon Border Adjustment Mechanism
CLM : Conditional Logit Model
ECB : European Central Bank
EF : Electric Arc Furnace
EGD : European Green Deal
EP : European Parliament
ETS : Emissions Trading Systems
EU : European Union
EPDK : Republic of Türkiye Energy Market Regulatory Authority
GDP (PPP): Gross Domestic Product (Purchasing Power Parity)
GGCC : Greenhouse Gas Conversion Coefficient
GHG : Greenhouse Gas Emissions
IF : Induction Furnace
IIA : Irrelevant Alternatives Assumption
IID : Independent and Identically Distributed
IPCC : Intergovernmental Panel on Climate Change
MLM : Mixed Logit Model
MoEUCC : Ministry of Environment, Urbanization and Climate Change
MWTP : Marginal Willingness to Pay
PV : Photovoltaic
RE : Renewable Energy
RUM : Random Utility Model
RUT : Random Utility Theory
TÜSİAD : Turkish Industry & Business Association
UN : United Nations
WTO : World Trade Organization
WTP : Willingness to Pay

YETA : Renewable Energy Supply Agreement

YEK-G : Renewable Energy Guarantees of Origin System

CHAPTER I

INTRODUCTION

The European Union's Carbon Border Adjustment Mechanism (CBAM) aims to reduce carbon emissions by placing a surcharge on imported goods based on their carbon footprint. Consequently, we anticipate that companies affected by CBAM will strive to reduce their CO_2 emissions, thereby accelerating the transition to renewable energy as one of the primary strategies. This effort aims to identify firms' trends and preferences regarding this transition and facilitate the government's necessary infrastructure design for the renewable energy (RE) market. As one of the world's largest exporters, Türkiye is expected to be significantly impacted by the CBAM, as it will increase the cost of exporting goods to the European Union (World Steel Association 2023).

While CBAM is seen as a significant challenge for Türkiye, it can also present an opportunity by taking the proper steps can mitigate it and help Türkiye develop GHG emission reduction strategies aggressively and implement them. Acar et al. (2021) examine the potential impacts of CBAM on the Turkish economy, and the study utilizes a dynamic, multi-sectoral applied general equilibrium (AGE) model to assess the overall macroeconomic impact of the European Green Deal (EGD) and the CBAM. The findings show that the CBAM may negatively impact the Turkish economy but highlight the potential benefits of a more active climate policy.

Iron and steel, electricity, fertilizer, aluminum, and cement are the pivotal sectors subject to the CBAM. Among these, the steel industry holds significant prominence within the Turkish economy, concurrently contributing substantially to the country's greenhouse gas (GHG) emissions. As per the Climate Transparency Report: Comparing G20 Climate Action, 2022, steel production stands out as a noteworthy source of GHG emissions and poses inherent challenges in terms of decarbonization (Enerdata, 2022; World Steel Association, 2021). To emphasize the importance of the steel industry within the context of global trade, Table 1.1 provides an overview of the top 15 net exporters and importers of steel in the year 2020, where Türkiye emerges as one of the top ten net exporters. Furthermore, Table 1.2 presents data on the total CO_2 emissions originating from the steel industry, measured in Mt of CO_2 (Hasanbeigi, A. 2022).

Rank	Net Imports (imports-export)	Mt	Rank	Net Exports (exports-imports)	Mt
1	United States	13,6	1	Russia	26,4
2	Thailand	11,9	2	Japan	24,8
3	European Union (28)	10,0	3	South Korea	16,1
4	Philippines	6,6	4	Ukraine	13,9
5	Vietnam	6,0	5	China	13,5
6	Saudi Arabia	5,7	6	India	12,1
7	Poland	5,6	7	Brazil	8,7
8	Mexico	4,5	8	Turkey	6
9	Indonesia	4,2	9	Egypt	4,2
10	Israel	3,3	10	Germany	3
11	Bangladesh	2,5	11	Taiwan, China	2,7
12	Myanmar	2,5	12	Austria	2,6
13	Uzbekistan	2,5	13	Malaysia	2,6
14	Pakistan	2,3	14	Belgium	2,5
15	Kenya	2,2	15	Oman	1,8

Table 1.1. Top 15 Net Exporters and Importers of Steel in 2020 (Worldsteel, 2021)

Countries	Total CO_2 emissions from steel industry (Mt CO_2)	Share from total emissions (%)
China	1,967	54,1%
Rest of the World	634	17,4%
India	239	6,6%
Japan	187	5,1%
South Korea	117	3,2%
Russia	108	3,0%
U.S.	84	2,3%
Germany	56	1,5%
Brazil	55	1,5%
Ukraine	49	1,3%
Vietnam	34	0,9%
Türkiye	34	0,9%
France	20	0,6%
Mexico	19	0,5%
Italy	18	0,5%
Canada	15	0,4%

Table 1.2. Total CO_2 Emissions from Steel Production in the Countries Studied and the Rest of the World in 2019 (in Mt CO_2) (Worldsteel, 2021)

Within the context of electricity generation in Türkiye, the utilization of renewable energy sources has gradually increased. Nonetheless, this rise remains relatively modest when juxtaposed with the utilization of other resources, particularly coal and natural gas, which collectively constitute approximately 19.1% of the nation's total electricity consumption (TETC, Electricity Generation-Transmission Statistics of Turkey). Consequently, the examination of Carbon Border Adjustment Mechanism's (CBAM) impacts on renewable energy demand and the conduct of Turkish steel producers holds paramount significance for several compelling reasons. First, the introduction of the CBAM can increase the cost of imported steel products to the EU, including those produced by Turkish steel producers. Hence, if the products emit more carbon than other producers, the demand for these products can reduce, creating a competitive disadvantage for Turkish steel producers in international markets. As a result, Turkish steel producers may need to find alternative ways to remain competitive, such as increasing their energy efficiency or adopting renewable energy sources in their production processes (Bayer & Urpelainen, 2016). Second, CBAM can encourage Turkish steel producers to reduce their carbon emissions to avoid or minimize the carbon costs associated with their exports. Hence, the shift in behavior towards adopting renewable energy sources with a lower carbon footprint than fossil fuels is expected to happen. Adopting renewable energy sources can empower Turkish steel producers reduce their carbon emissions and improve their environmental performance, making their products more attractive and competitive internationally (Hughes et al., 2018). However, successful adoption of renewable energy sources in the steel industry depends on a combination of factors including the accessibility and cost-effectiveness of renewable energy technologies, the regulatory framework for renewable energy, government support, and Turkey's overall energy demand and consumption (Pfeiffer & Mulder, 2013).

The Carbon Border Adjustment Mechanism (CBAM) will enter into force on 1 October 2023 with a transitional phase, and it means that companies must start reporting carbon emissions associated with the import of certain goods from October 1, 2023. While the first reporting period will end on January 31, 2024; the transition phase will run from October 1, 2023, to December 31, 2025 and the complete eligibility phase of CBAM will begin on January 1, 2026. Based on these facts and provided references, this thesis analyzes the effects of CBAM on steel producers' demand and behavior toward renewable energy in Türkiye. By examining the impact of CBAM on Turkish firms' demand, policymakers and businesses can develop strategies to mitigate the effects of the CBAM and ensure a smooth transition to a low-carbon economy. The findings of this study provide valuable insights into the steel firms' preference toward the transition to RE usage, and it can guide policymakers in designing effective policies to address the challenges posed by climate change.

The rest of the thesis is organized as follows: Chapter II gives background information on the CBAM, and introduces the conceptual framework relevant to climate change and the relationship between choice experiments and carbon pricing. Chapter III overviews the literature on choice experiments and willingness to pay. Chapter IV presents the methodological approach adopted, with special emphasis on the Random Utility Model (RUM), Discrete Choice Experiment (DCE), and Mixed Logit Model (MLM) in particular. Chapter V reviews the questionnaire and its construction. Chapter VI introduces the model and presents econometric results. Chapter VII discusses the results and gives policy recommendations. Finally, Chapter VIII concludes the thesis.

CHAPTER II

BACKGROUND

This chapter provides a general overview of the carbon pricing mechanisms and their relation with choice experiments. Carbon pricing is a policy that puts a price on carbon emissions through various mechanisms. It places a monetary value on the externality caused by the emission. Given the set value, companies decide whether to abate or emit. The CBAM is a type of carbon pricing designed to prevent carbon leakage. In this chapter, first, the crucial concepts for climate change are mentioned, and then the connection between choice experiments and carbon pricing is discussed.

2.1. Carbon Pricing Mechanisms

Extreme weather events, drought, and fires have become a part of our World due to climate change in the past years. The effect of this change underlines as "human-induced and beyond the natural climate variability" by the Intergovernmental Panel on Climate Change (IPCC, 2022). IPCC advises scientific, technical, or socioeconomic works on climate change and publishes assessment reports every 5 to 7 years on the World's climate system. Selznick (1957) describes this as "policy-relevant but not-prescriptive." The reports of the IPCC inform international policy-makers and the World about the importance of setting targets to prevent climate change (Paglia et al., 2021). There are several groups in the report of the IPCC. “The first group focused on physical science; the second was examine the impacts, adaptation, and vulnerability” (IPCC, 2022). The final working group determined the mitigation of climate change. According to Sixth Assessment Report (AR6), there are crucial results preposterously regarding climate change, and some of them are presented as follows:

- Extreme weather events are increasing enormously, and their consequences affect the World.
- CO_2 levels are at their highest in 2 million years.

- Climate targets of 1.5 and 2 degrees of Celsius become "inaccessible."
- The methane and nitrous oxide levels, the second and third most significant warming causes, respectively, were also exceptionally high.
- IPCC study groups worked on several scenarios about the facts when the temperature is higher at different levels. (IPCC, 2022).

To summarize, the IPCC associated the onset of climate change with the Industrial Revolution and stated that increasing greenhouse gas emissions (GHG) with industrialization caused an increase in the temperature. Therefore, they identify one of the leading causes of climate change as GHG (IPCC, 2022). GHG should be reduced worldwide as soon as possible with the help of various mechanisms to prevent climate change. They also examined how to reduce GHG efficiently, and there are two main topics. The first one is that renewable energy sources should be used to keep the adverse effects of GHGs at a certain level. The second one is that fossil energy usage should be stopped as much as possible. Technological filter systems such as carbon capture, carbon storage, and sequestration technologies may be effective if these fuels are necessary. However, polluters continue their activities when they do not face any enforcement to reduce GHGs. Therefore, carbon pricing is one of the most potent tools to prevent climate change (The World Bank, 2022). This mechanism aims to reduce GHG by surcharging a carbon payment linked to carbon emissions. It also allows firms or individuals to consider the climate change effects of their activities and integrate their external costs into their economic decision-making to enable a smooth transition to a decarbonized economy. (The World Bank, 2021a).

Different carbon pricing mechanism variants include emissions trading systems (ETS), carbon tax, carbon credit mechanisms, and hybrid approaches. ETS has been identified as a significant contributing factor to the GHG decline and reaching emission targets (IETA,2022). Furthermore, the European Commission examined this mechanism to incentivize the transition to clean energy (European Commission, 2015, p.5). Another variant, called carbon tax charged based on carbon emissions.

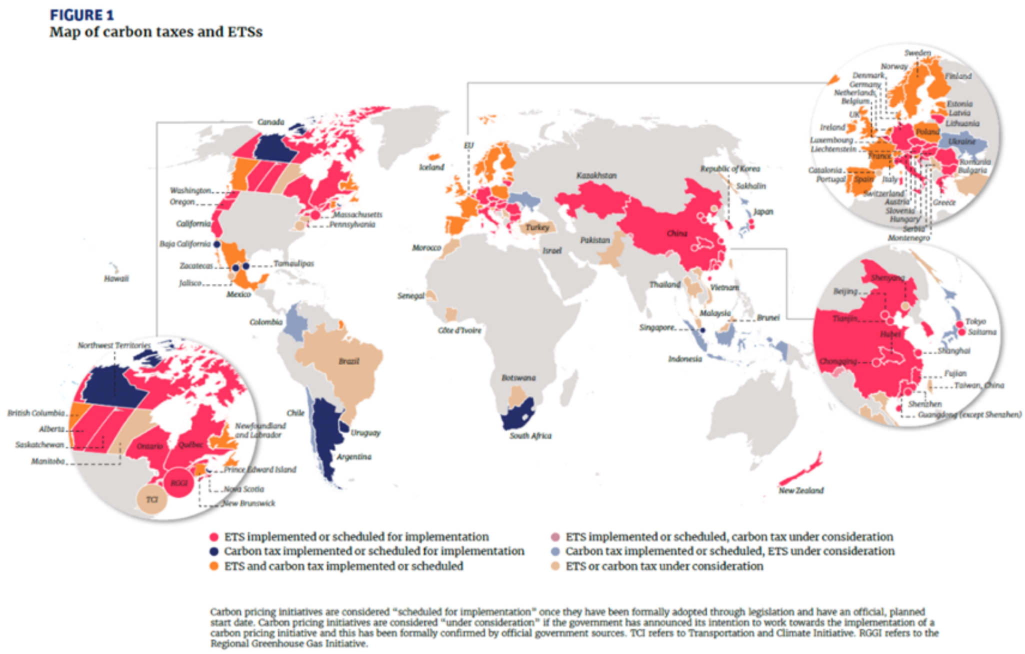
In this mechanism, the government's carbon tax is derived based on the emission target level set by marginal abatement cost and marginal damage cost (The World Bank, 2022). According to Nordhaus (2007), this mechanism may describe as a Pigouvian tax because of the balance between reduced social marginal cost and the benefit of additional GHG emissions. Although there are several advantages, such as quick generating of revenues and avoiding volatility in price, there needs to be more certainty about the environmental effects. (Nordhaus, 2007, pp.37-42; The World Bank, 2017, p.10) A carbon tax differs from the ETS because ETS can achieve the emission target. The last variant is a mechanism by which businesses can generate carbon credits. “The carbon credit mechanism refers to a system where tradable credits are generated through voluntarily implemented emission reduction activities. Global carbon credit markets consist of various sources of supply, demand and trading frameworks” (The World Bank, 2022).

Türkiye has been working on finding the best carbon pricing system for the country, and the Republic of Türkiye Ministry of Environment, Urbanization, and Climate Change announced that they will introduce ETS.

2.1.a. Overview of World Carbon Pricing Mechanisms

Carbon pricing is one of the most powerful tools to guide economies to an integrated policy mix. Sixty-eight carbon pricing initiatives are operating worldwide, including taxes and ETSs, and four more are planned according to the World Bank’s State and Trends of Carbon Pricing, 2022 report. While 32 of the 68 are ETSs, 36 are carbon taxes. With the help of new initiatives, GHG coverage is increased compared to the year before. (The World Bank, 2022). Figure 2.1 summarize the map of carbon taxes and ETSs.

Figure 2.1. Map of Carbon Taxes and ETSs



Source: The World Bank

Today's heavy GHG emissions and net-zero carbon emission targets should be the driving forces for the World to go into action as quickly as possible. Most countries and organizations are working on carbon pricing mechanisms in various ways. According to the Net Zero Tracker, 133 countries, 116 regions, 241 cities, and 820 companies have carbon-neutral goals to be achieved by 31 January 2023. Additionally, they work on the country-level global net zero coverage as of Jan 2023, while these covered 83% of the emissions and 91% of the GDP (PPP) (Net Zero Tracker, 2023). According to the latest working report of the European Central Bank (ECB), ETS contributes to reducing GHG. On the other hand, the CBAM aims for equal competitiveness between the companies which import to the EU, preventing the carbon leakage problem. Therefore, the collaborative design of ETS and CBAM can reduce the risk of carbon leakage while reducing global greenhouse gases (Böning, Nino, and Folger 2023).

2.1.b. EU Green Deal and CBAM

The European Union announced that the Green Deal (GD) aims to create a carbon-zero region by 2050 and sets a “target of a 55% reduction in carbon emissions between 1990 and 2030” (European Commission,2019c). The GD is a comprehensive plan which includes CBAM, a just transition fund, a new industrial strategy, a new energy policy, a new transport policy, a new agricultural policy, and a unique biodiversity strategy. Figure 2.2 illustrates the various elements of GD.

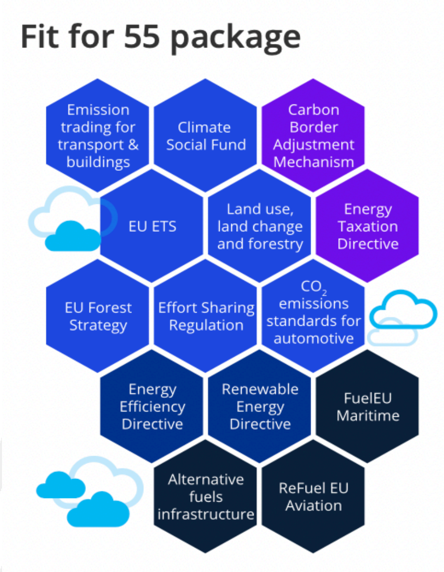
Figure 2.2. The European Green Deal

Source: European Commission, 2019c

“Carbon leakage” occurs when EU policies are mainly trying to achieve the greenhouse gas reduction target. Carbon Leakage is a crucial explanation for the relocation of production. While it mainly addresses the problem of the EU losing its production sector to the outside, the problem of importing polluting industries also arises for other countries. The leakage problem affects almost all sectors, but the effect on some industries is much more significant. The risk of carbon leakage may be higher in energy-intensive sectors such as iron and steel (A European Union Carbon Border Adjustment Mechanism: Implications for Developing Countries, UNCTAD, 2021). Because of this reason, the EU took a concrete step called the CBAM as a part of the "Fit-for 55 package" to prevent carbon leakage and reach a

55% reduction of emissions target. This package focuses on specific topics about the transition to the decarbonized World. The main issues of the Fit for 55 package are shown in Figure 2.3.

Figure 2.3. Fit for 55 Package



Source: KPMG, 2022

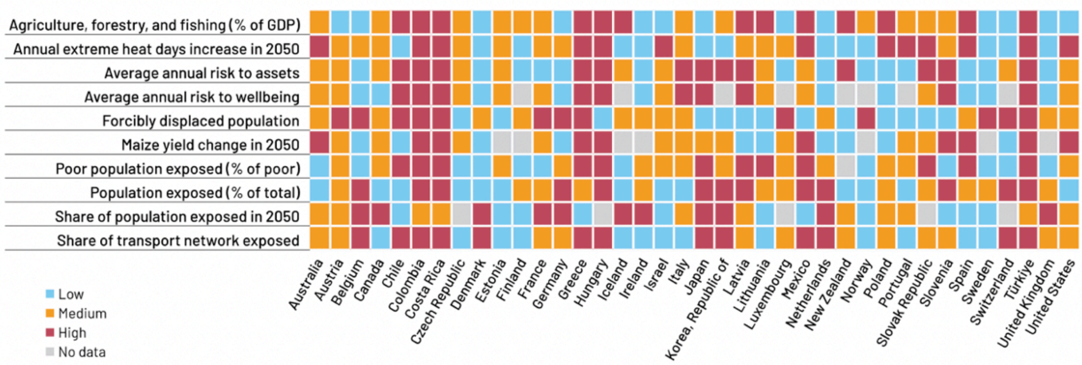
CBAM is "designed in compliance with World Trade Organization (WTO) regulations and other international obligations of the EU," and it has affected not only EU countries but also non-EU countries (European Commission, 2022). Therefore, it is an essential concept for the World. While Acar, Aşıcı, and Yeldan (2022) determined the CBAM as one of the most strategic decisions for reducing carbon leakage, Neuhoff (2011) mentioned that it aims to eliminate carbon cost differences and European Commission recognized it as a supporter of the EU's increased ambition for climate mitigation. There are three scopes of the CBAM, and each scope represents the different levels of carbon emissions. While scope one emissions have direct GHG "emissions from owned or controlled resources, scope two emissions include indirect emissions from the generation of purchased energy". Scope three emissions include all indirect emissions not included in scope two (WBCSD & WRI, 2012). The European Parliament (EP) adopted the European Union ETS and CBAM revisions package on 22 June 2022. According to this new package, scope extensions have been implemented. Before the revision, iron &

steel, cement, fertilizer, electricity, and aluminum sectors were included, while after the modification, organic chemicals, plastic polymers, hydrogen, and ammonia were added. Scope 2 has been included in the covered scopes starting from 2026. Other revisions are establishing a central EU CBAM authority to be more efficient and transferring the revenues from the sales of CBAM certificates to the EU budget, thus moving them as financial support for the least developed countries. While the CBAM enters into application in its transitional phase by 1 October 2023, the first reporting period for importers end by 31 January 2024, and the full implementation will start on 1 January 2026 (European Commission, 2022).

2.1.c. Turkish Carbon Tax and Carbon Trading Mechanism

Following the signing of the Paris Agreement in October 2021, the Republic of Turkiye announced its commitment to achieve the Net Zero Carbon Emission target for 2053, a timeframe extending three years beyond the target envisioned by the European Union (EU). Following the Paris Agreement, Türkiye took a concrete step towards preventing climate change. However, this step in Türkiye requires enormous developments in many sectors because of the high climate risk (see Figure 2.4) (World Bank, Country Climate and Development Report: Türkiye, 2022). The country started establishing new climate change institutions, such as the Ministry of Environment, Urbanization and Climate Change (MoEUCC), and it updated the National Climate Change Action Plan because of the high climate risk (World Bank, Country Climate and Development Report: Türkiye, 2022).

Figure 2.4. Climate Risk Vulnerability in Türkiye and the Other OECD Countries



Notes: Countries are rated using a benchmark approach: those rated at high risk (red) are in the top third, medium risk (yellow) are in the middle third, and low risk (blue) are in the lowest third.

Source: World Bank, (Country Climate and Development Report: Türkiye, 2022)

There are also several considerations about Türkiye 's policy situation and economy regarding climate change. According to the Turkish Industry & Business Association (TÜSİAD) 's report, the attempts to reduce carbon emissions may cause a decline in national income. Yeldan et al. (2020) propose a neutral tax that provides some initiative against the energy tax burden regarding the results. Similarly, Acar, Aşıcı, and Yeldan (2022) suggest that the parliament should take action about the emission trading system in Türkiye and preferably linked to EU ETS. According to Aydın (2018), the revenue from carbon taxation may have a regressive effect, especially for low-income households, and to finance technological transformation for climate finance opportunities. Another critical point is that public & private sector differences should be considered when establishing climate policies and ETS mechanisms. (Özokcu, 2022)

CHAPTER III

REVIEW OF THE LITERATURE

The carbon pricing mechanism encourages those responsible for high emissions to use renewable energy based on the “polluter pays” principle. According to the World Bank, this mechanism is necessary to reduce greenhouse gasses. Some countries have already taken action to evaluate the carbon pricing mechanism to prevent climate change and, thus, higher emissions.

The choice experiment is a survey-based methodology that allows us to determine attributes of the services or products to understand the decision-maker's preferences. It is based on stated preferences and provides control of attributes and levels commonly used to investigate environmental economics, health economics, and marketing. In the meantime, the choice experiment examines consumers’ willingness to pay (WTP) for possible changes in environmental circumstances, and it can generate monetary WTP estimates of use and non-use values. Thus, it is crucial to use it in countries' carbon pricing work in progress. Additionally, this methodology allows us to understand WTPs for each attribute and is highly flexible in designing future policies. There are several approaches to choice modeling methodology. The DCE methodology is derived from Lancaster’s (1966) characteristics of the demand model and Random Utility Theory (RUT) that explains the dependency on the utility maximization commonly used in the literature. According to Lancaster’s approach to Consumer Theory, there are three main ideas about goods. “First, the good does not give utility to the consumer, but characteristics give rise to utility.” (Lancaster, 1966).

Similarly, Hanis et al. (2013) mentioned that “Lancaster’s Theory argues that consumers derive utility not directly from goods or services but from their characteristics. Second, the good will possess more than one characteristic, and many characteristics are common to more than one good. Third, combined goods may possess characteristics different from those of individual goods (Lancaster, 1966). Since then, DCEs have become increasingly popular in environmental valuation" and commonly used in previous literature such as Adamowicz et al., 1998; Louviere, Hensher, and Swait, 2000; Hanley, Mourato, and Wright, 2001; Bennett and Blamey, 2001; Adamowicz, 2004; Kanninen, 2007; Hoyos, 2010; Hensher, Rose, and Greene, 2015. This methodology covers questionnaire and experimental design, econometric analysis of choice data, MWTP, WTP estimates for changes in the attribute levels, and interpretation of results. It analyzes choice data by constructing a hypothetical market and participants' choices among the attributes and levels (Hoyos, 2010). DCE aims to identify the attractiveness of the attributes and "derive from the attributes conforming to an environmental good or service undervaluation" (Hoyos, 2010). Also, it can "provide the opportunity to elicit a deeper understanding of the trade-offs between different attributes" (Adamowicz et al., 1998; Jin et al., 2006). Additionally, it is firmly rooted in RUT, allowing researchers to test hypotheses against demand theory (Hensher et al., 2015). Because of these reasons, the research in this field is intense, although many challenges are put forward, such as choice-task complexity, experimental design, or model creation (Hoyos, 2010). There are a few papers with firms that have investigated renewable energy adoption behavior over the past decade, and DCEs have become a popular stated preference (SP) method for environmental valuation (Hoyos, 2010). While the DCE methodology is predominantly used from a household perspective in the literature, some studies have also investigated investors' perceptions of their participation in renewable energy, such as Chassot et al., 2014; Goett et al., 2000; Lüthi and Wüstenhagen 2012; Masini and Menichetti, 2013; Roe et al., 2001; Salm, Hille, and Wüstenhagen, 2016.

Chassot et al. (2014) empirically explore investors' perceptions of regulatory risk and their impact on investment decisions. Using the DCE, including attributes used with 29 venture capital investors from Europe and the United States, the study focuses on "the extent to which investors' worldviews drive the impact of regulatory risk on the decision to invest in RE." The results show that high exposure to regulatory risk undermines investment decisions in renewable energy. In addition, it has been revealed that investors' worldviews play an essential regulatory role beyond being just "rational." The findings of this paper suggest that while governments should carefully consider the level of regulatory risk when designing policies to promote the adoption of renewable energy, investors should also be aware of their divergent worldviews (Chassot et al., 2014).

Salm, Sarah N. 2018 used a CE with two groups of investors: incumbent utilities and institutional investors. This research involved 52 managers from these two groups who answered investment decisions in a simulated market. This article details the differences between the two groups in willingness to invest. Results showed that there are differences in the risk perceptions of these two groups of investors. On the other hand, the risk of perceptions varies depending on the type of RE (Salm, 2018).

Salm et al. (2016) analyzed the risk perceptions of 1990 German renewable energy investors. While examining investors' willingness to accept certain attributes of renewable energy investments, such as the choice of renewable energy technology or the proximity of the project location, this study also aims to identify the target segments of these investors. The results showed that participating investors made decisions based on simple payback calculations or intuition rather than complex analyses. In addition, their findings support that investors make decisions not only for environmental issues but also for financial returns (Salm et al., 2016).

Goett et al. (2000) established the preferences of small/medium commercial and industrial consumers in the United States using a choice experiment. This study estimates the WTP distribution of customers based on more than forty attributes. An attempt has been made to define attributes more precisely and work with more attributes. A mixed logit model represents the choices in this research, and the share of customers with positive WTP with their rates for different non-price attributes is the most reliable information for this research. The results showed that the customers are willing to pay for service attributes depending on their preferences and location. Retail energy suppliers may use these findings to develop strategies for different segments of customers (Goett et al., 2000).

Lüthi and Wüstenhagen (2012) suggest that project developers deciding among photovoltaic investment opportunities in different countries should choose the country with the most appropriate risk-return profile. Preference should be based on carefully weighing feed-in tariff-induced returns against policy risks. The methodology of this research is a choice experiment that includes attributes that are applied to 63 investors. The results showed that policy risk is vital for photovoltaic (PV) investment decisions, and the government should be careful when defining the level of risk that can assign a "price tag" to specify them. Hence, this research claimed the importance of "non-economic" barriers to deploying renewable energy by measuring the "price of policy risk" (Lüthi and Wüstenhagen, 2012).

On the other hand, Danne, Meier-Sauthoff, and Musshoff (2021) focused on the households, and they investigated the German consumers' WTP for green electricity tariff attributes with DCE. They have generalized the multinomial logit model in WTP space conducted in 371 German private households. Results showed that the consumers' decision is mainly affected by the source of green energy. The findings indicated that politics should support wind and solar energy as German consumers prefer them (Danne, Meier-Sauthoff, and Musshoff, 2021). Likewise, Oluoch et al. (2021) and Bae, Rishi, and Li (2021) investigated consumer preferences for renewable energy with the DCE methodology. Oluoch et al. (2021) used a DCE to estimate the values of RE improvements in Kenya. The results provide information on choices for RE and can inform the development of renewable energy policies. Similarly, Bae, Rishi, and Li (2021) used a DCE to examine consumers' preferences, and the findings provide important insights into South Korean consumers' preferences for RE.

Adaman et al. (2011) investigated the willingness of Turkish urban households to pay for CO2 emission reductions expected to result from improvements in energy production. This research implemented a contingent valuation face-to-face questionnaire to 2422 respondents from 26 cities to measure Turkish urban residents' WTP for a project to mitigate climate change. The choices of the participants in the results show that young, educated, and knowledgeable people have higher WTP, but the general lack of trust in institutions negatively affects them in terms of WTP. They also found that income was significant in WTP. Hence, the research suggested that building trust is an important first step in getting people to support environmental initiatives.

Similarly, Gökşen et al. (2001) analyzed the WTP of 1565 respondents from Istanbul to specify the determinants of environmental concerns. This research used the Contingent Valuation technique, and the valuation issues are sea pollution, soil erosion, and ozone depletion. The findings indicate that local environmental concern was found to be significantly higher than global environmental concern, and material security is the only significant explanatory variable for WTP for national environmental improvement. Postmaterialist values are more vital than education and urbanity in determining WTP for local environmental improvement.

This chapter has attempted to summarize the case studies using a DCE and provides a general overview of carbon pricing mechanisms and WTPs. Being aware of the importance of CBAM, this research examines the demand and behavior of transitioning to renewable energy in the steel industry, one of the sectors with the highest CO_2 emissions. It also contributes to the literature by analyzing sectoral demands and behaviors in the transition to renewable energy and proposing policies to accelerate the transition process.

CHAPTER IV

THEORETICAL FRAMEWORK

4.1. Random Utility Model

The discrete choice experiment models offer different options that may be hypothetical or existing to the respondents to choose one of the alternatives. Choosing between these alternatives is usually modeled under the assumption of utility. Although this model assumes profit maximization, sometimes consumers may have to choose something other than the alternative we expect. Accordingly, a random element can enlighten these attitudes. (Adamowicz et al., 1998).

The utility function is depicted by:

$$U_{ni} = V_{ni} + \varepsilon_{ni}. \qquad (4.1)$$

Utility of individual n choosing the state i is represented as U_{ni}, then location will be chosen if and only if $U_{ni}>U_{nj}$ for $i \neq j$.

While V_{ni} represents the observable part, ε_{ni} is the unobservable component of the utility. The observable part of the utility depends on the features such as attributes. (Hensher, Rose, and Greene 2005) (Kenneth E. Train, n.d.)

This research defines a Random Utility Model as follows:

$$U_{ni} = V(x_{ni}, p_{ni} ; \beta_n) + \varepsilon_{ni}. \qquad (4.2)$$

x_{ni} is a vector of attributes of profile i, p_{ni} is the cost of profile i, and β_n is the vector of the parameters in equation (4.2).

i is the chosen alternative on C if and only if

$$U(\text{choice } n_i)>U(\text{choice } n_j)\ \forall i \in C,\ i \neq j$$

or other words,

$$V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \quad \forall j \in C, \; i \neq j. \qquad (4.3)$$

The critical point is that if the utility is random, the preference is not deterministic, and due to that, probabilities should be defined, as well. Due to the lack of knowledge about error terms, the only thing that we can do is use probability.

$$P_{ni} = Prob[U_{ni} > U_{nj}]$$

$$= Prob[(V_{ni} + \varepsilon_{ni}) > (V_{nj} + \varepsilon_{nj})] \quad \forall j \in C, \; i \neq j. \qquad (4.4)$$

Standard error terms should be independently and identically distributed (IID), a crucial notion describing closeness to reality in RUM. They also follow the type I extreme value distribution. Type I extreme value distribution provides modeling/measuring the events that occur with a small probability. Besides, extreme value distributions provide limiting distribution for IID random variables as the sample increases. These distributions are widely used in several disciplines dealing with extreme events. In this research, we use the type I Extreme Value function, which is also called Gumbel distribution. Since we use the type I Extreme Value distribution, the difference between the two error terms follows logistic distribution. Hence, we use logistic models for the estimation. Also, the probability choice can be expressed in the logistic distribution (Pearce et al., 2002). These features indicate the multinomial logit model. (Mcfadden, 1974) Before the definition of logit specification, we should note that, because of the IID distribution, the multinomial logit model has some restrictions: Preferences are in rapport with Independence from the Irrelevant Alternatives (IIA) assumption, and they are homogeneous for all participants. All errors have identical scale parameters (Holmes et al., 2003). However, the random parameter logit model used in this thesis allows the heterogeneity of parameters.

There is a connection between the RUT and the decision mechanisms of investors. RUT assumes that participants have preferences for characteristics of alternatives, even if those preferences are ambiguous. Therefore, each investor can make their choices by looking at the attractiveness of the offered features. Therefore, it is a fundamental mechanism for modeling investment decisions and developing policy outcomes. Since the choice experiment technique is based on Random Utility Theory, it can be used to examine the decision mechanisms of households and investors to develop investment strategies tailored accordingly. It presents a range of choices among different investment options to the participants. The experiment designs are as realistic as possible and reflect the different scenarios investors may face. The choices made by the participants in the experiment are used to predict investment decisions and develop policies accordingly.

4.2. Discrete Choice Experiment

DCE technique is based on the opinion that fits with Lancaster's characteristic demand model that value is derived from attributes. The first studies of DCE are developed by Louviere and Hensher (1994) and Louviere and Woodworth (1983) through the discussion of theory and methodology. Although it may seem like a simple methodology, as Bateman et al. (2002) emphasize, defining goods in terms of their qualities is challenging.

The DCE observes how people choose from a given set of choices, even in hypothetical scenarios. It also helps quantify the environmental goods by focusing on modeling options that vary according to various attributes. While the analysis of this technique is based on RUM which “assumes a stochastic consumer decision process in which goods are treated as discrete” (Dahlberg et al. 2003), the application of DCE has the following stages:

1- Specification of the problem
2- Description of attributes and their levels
3- Description of discrete choice experiment
4- Questionnaire development
5- Data collection
6- Model estimation
7- Results interpretation

8- Policy recommendation

The application of DCE starts with the specification of the problem. The research problem should be determined in detail, and attributes and levels should be identified depending on the problem. “These attributes and levels are systematically varied to determine the respective influence on the selected decision” (Louviere, Hensher, and Swait, 2000). Using this attribute-based measure of preferences gives us the advantage of asking for their WTP value to the participants directly. However, we can only use some combinations of attributes and levels because we must eliminate alternatives with unrelated influences for a proper analysis. For this reason, the number of alternatives in this study is reduced by fractional factorial design. When completing the identification process, the description of the DCE and questionnaire starts. DCE offers a scenario that includes several attributes and levels for the participants, and it waits to choose one of these profiles or none. Therefore, the experimental design consists of profiles and choice sets with the best combination of attributes and levels. In this research, each choice set has two profiles and a status quo option. One of the advantages of the DCE methodology is that each attribute of the good or service can be calculated separately. For that, Orthogonal design can predict changes separately without any correlation. This design also provides individual-level preference heterogeneity, and since we are not sorting, there is no need to check for transitivity.

The questionnaire has several parts: general questions, demographic questions, choice experiments, and others that include the questions you want to ask. It has to include clear explanations about each part and should have different versions regarding the diversity of profiles in the DCE. The essential part is identifying the target population and choosing the sample. Although there are several approaches to small sample sizes, the DCE technique has advantages. Smaller sample sizes can be employed if more information per respondent is collected, such as Choice Modeling, where multiple choices are elicited from each participant. (Pearce et al., 2002). While DCE is a specific type of Choice Modeling that presents sets of choices to individuals and analyzes their preferences, Choice Modeling encompasses a broader range of methods for modeling and analyzing individual decisions, and the process depends on the research objectives and context. However, we should be more careful about small sample sizes than large ones. Because of the sample size limitations, each participant should understand and answer all parts of the questionnaire more appropriately than others. After deciding on the sample size and collecting the data, model estimation and econometric analysis should be done, and depending on all these analyses, the results are interpreted. Finally, some policy recommendations can be made at the end of the research.

4.3. Mixed Logit Model

As mentioned, the first step of implementing the model is describing the indirect utility function and adding a random element; the analysis becomes a probabilistic choice. The probability distribution of random elements is generally chosen as Gumbel or extreme value types of distributions in the DCE. Particular choice probability can be expressed in terms of the logistic distribution. While the choice is between two options, the model is described as a binary logit model; the dependent variable takes three or more values and becomes a conditional or multinomial logit model (Pearce et al., 2002). Since the probability distribution assumptions cause several discrete choice experiments, we should focus on the best type for this research (Cushing B. 2007).

Whereas the conditional logit model (CLM) works with only alternative variant regressors, the multinomial logit model works with only alternative invariant regressors. Both models have restrictions to the limitation of the Independence from IIA assumption. According to that, the probability ratio of people choosing between two alternatives does not depend on the characteristics of the other alternatives. Hence, IIA restrictions can cause a problem in the analysis. These other models, including nested logit, mixed logit, multinomial probit, and heteroscedastic extreme value models, have been developed to relax IIA assumptions (Cushing B. 2007), and due to that, they are preferred rather than CLM and multinomial logit model, even if more challenging to estimate.

The MLM, also known as the random parameter logit model, uses alternative variants and invariant regressors. There are no limitations for IIA assumption, and parameters estimate to vary across individuals, which means the choice structure is heterogeneous. The mixed logit model also assumes error terms are iid with Type I extreme value distribution.

In the MLM, the person's utility defines as:

$$U_{ni} = V_{ni} + \varepsilon_{ni} \quad (4.5)$$

where U_{ni} defines utility, V_{ni} is the observable part of the utility, ε_{ni} is the unobservable part of the utility obtained from product i, and respondent n.

We can estimate utility only if we know the probability density function. “Marschak is the first person that provide the nonconstructive proof to show that the Type I extreme value distribution of the random part of utility ε_{ni} can lead to the logistic distribution of the difference between two random terms (ε_{ni}- ε_{nj}). The proof was developed by E. Holman and A. Marley and completed by Daniel McFadden (1974). So the choice probability P_{ni} of CLM has a brief and closed form" (Zeng 2011, 6). Here, C is the alternative set that includes i and j alternatives.

$$\text{Prob}[(\varepsilon_{nj}-\varepsilon_{ni}) < (V_{ni}-V_{nj})],\ \forall j \in C,\ i \neq j \quad (4.6)$$

The probability of i is chosen out of alternatives when we assume the error term as Gamble in the below:

$$P(i|C)=\frac{\exp(\mu v_i)}{\sum_{J\in C}\exp(\mu v_J)} \quad (4.7)$$

Additionally, it is simple to calculate MWTP for any attributes in the mixed logit model. The MWTP for one unit increment of the attribute x is calculated as follows:

$$\text{MWTP}_x = \frac{dp}{dx} = -\frac{\frac{\partial V}{\partial x}}{\frac{\partial V}{\partial p}} = -\frac{\beta_x}{\beta_p} \quad (4.8)$$

βp represents the price parameter, and βx is the attribute parameter. The ratio of these parameters gives us the marginal willingness to pay. MWTPs are obtained with the help of coefficients, and positive results mean that participants are willing to pay a positive amount equal to the coefficient for one unit of good or service.

CHAPTER V

CONSTRUCTION OF QUESTIONNAIRE

This chapter examines all the stages of the questionnaire's construction process. The first part of the chapter mentions the attributes and levels, and the second part describes the experiment size.

The questionnaire is designed to reveal the demands and behaviors of steel producers in Türkiye regarding the transition to renewable energy. There are two versions, and each has five parts. The questions in the discrete choice experiment section of the questionnaire differ in these two versions, but the government support mechanism and time preference questions parts are the same. Having different versions of the questionnaire is crucial regarding the diversity of profiles in the experiment. Also, properly defining the boundaries of the questionnaire is one of the most challenging and essential parts of the experiment. Therefore, we decided to apply the experiment only to the steel industry, one of Türkiye 's most polluting sectors and one of the essential export items. The first part of the questionnaire includes general questions about companies' current status in renewable energy and their foreign trade capacity. The second part consists of demographic questions about the participant's age, gender, education level, and occupation. The third section is the central part of the empirical analysis, which consists of discrete choice experiment questions. This section presents two different profiles and the "none of them" option for the respondent. We expect them to choose a profile, assuming that they are the decision maker on behalf of the company regarding the use of renewable energy. Profiles consist of attributes and their levels in the choice experiment; therefore, their attributes and levels must be created before profiles can be made.

5.1. Attributes and Levels

Attributes are properties present or likely to occur in the future that fully describe goods or services. In this study, while determining the attributes, we focused on the "What kind of RE program would encourage the company to switch renewable energy?" question. As a result, four attributes were determined: "price difference, price guarantee, energy mix, and payment process." The first attribute, "price difference," shows the difference between regular and renewable energy in kr (Turkish penny)/kWh. While renewable energy is obtained from natural resources such as solar, wind, geothermal, hydroelectric, biomass, hydrogen, and wave energy, regular energy is obtained from fossil fuels. The following example has been shared with the participants to better understand the price difference attribute in the questionnaire. The prices of renewable and regular energy in terms of kr/kWh are in the table, coming from the Republic of Türkiye Energy Market Regulatory Authority (EPDK), effective from 01.07.2022. The price differences between them are 16.9244 kr/kWh, but we calculated the prices in terms of TL to make them easy to understand. The next step is to find the extra electricity price per 1 ton of CO_2. We used the price differences between the two energy types and the greenhouse gas conversion coefficient (GGCC), 0.000555 ton CO_2/kWh, and calculated the result in TL as 304.94 TL[1]. We also need to know the approximate carbon tax, and for the calculation, the average EU ETS carbon price for July 2022 and the average euro price were used. We set 1 Euro as 18 TL in our calculation and the average carbon price as 81.7 EUR. Table 5.1 is an assumption to show the situation clearly to the steel producers. Therefore, at the end of Table 5.1, it is seen that earnings per ton of CO_2 if switching to renewable energy is 1,165 TL.

Price of renewable energy (kr/kWh)	Price of regular energy (kr/KWh)	The price difference between renewable and regular energy (**TL**/kWh)	Extra electricity price per 1 ton of CO_2 (Renewable and regular energy price difference * (1/greenhouse gas conversion coefficient)) (TL)	Carbon tax payable if renewable energy is not adopted (TL)	Earnings per ton of CO_2 if switching to renewable energy (TL)
262.2851	245.3607	0.169244	304.94	1,470	1,165

Table 5.1. The Assumption for Earning if Switching to the Renewable Energy

[1] Extra electricity price per 1 ton of CO_2 = (The Price of Renewable Energy – The Price of Regular Energy) * (1/Greenhouse Gas Conversion Coefficient)

Additionally, if we assume that a company consumes 1000 MWh of electricity daily, the extra price to be paid if switching to renewable energy becomes 169,242 TL per day. Also, we know that the GGCC is 0.000555 tons CO_2/kWh. As 1,000 MWh equals 1,000,000 KWh, GGCC becomes 555 tons of CO_2. We also see the carbon tax payable if the company continues to use regular energy from Table 5.1. Therefore, the next step is calculating the carbon tax price to be paid daily if renewable energy is not adopted, which is 815,850 TL[2]. In the end, there is the extra price to be paid if switching to renewable energy and carbon tax payable as mentioned, so the gain from 1,000 MWh electricity consumption per day if the producers switch to renewable energy will be 646,608 TL. It is an unmissable amount for a company and will undoubtedly affect the decisions.

Extra electricity price per 1 ton of CO_2 (Renewable and regular energy price difference * (1/greenhouse gas conversion coefficient)) (TL)	Extra price to be paid daily if **switching** to renewable energy (TL)	Carbon tax price to be paid daily if renewable energy **is not adopted** **(TL)**[2]	The gain from 1000 MWh electricity consumption per day if renewable energy is switched to (TL)
304.94	169,242	815,850	646,608

Table 5.2. The Assumption for Electricity Consumption of 1000 MWh Per Day

The second attribute, the "price guarantee," indicates the duration of use in the tariff prices applied when you decide to use renewable energy. Renewable electricity prices are updated quarterly within the Green Tariff implemented in Türkiye. The third attribute, the "energy mix," aims to measure how much renewable energy companies want to use as a percentage during the transition to renewable energy. After announcing this attribute, decision-makers are reminded that the CBAM will affect Türkiye in several ways. They will be exposed to a carbon tax on the amount of carbon they emit while producing their products. Three payment packages with different benefits are offered for the fourth attribute, "payment process." Here it will be analyzed what steel producers are willing to pay for renewable energy. After the determination of attributes, we examined the levels of each attribute. Price difference levels are described in light of the price differences between renewable and regular energies and depend on the multiples of

[2] For the calculation of "carbon tax price to be paid daily if renewable energy is not adopted", we assume carbon tax payable if RE is not adopted is 1470 TL)

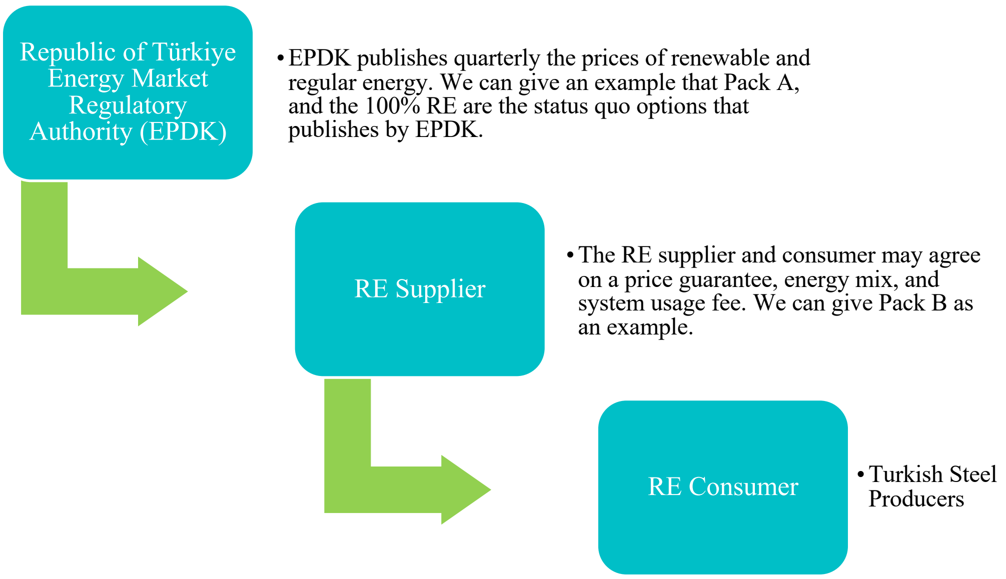
this exact number, as 16,9 kr. Selling RE separately is a new concept in Türkiye, and there is no stable price trend; therefore, the price differences chosen to be close to reality have been selected on many different multiplies, both small and big.

On the other hand, the price guarantee has four levels, and three months is a status quo set by EPDK's July 2022 Green Tariff Report. Usually, EPDK publishes reports quarterly. We decided to increase the levels with the same multiplies to see the price guarantee behavior. The third attribute, energy mix, may be considered a facilitator during the transition to renewable energy. Producers who find renewable energy risky may try one of these levels initially. From this point of view, several choices for the mix attributes show the steel producers' gain increase compared to 100% regular energy. The final attribute is payment packages which have three different levels. Pack A is the status quo option published quarterly by EPDK and has a system usage fee for once. Pack B concerted from a physical renewable energy supply agreement (YETA). This level has a system usage fee and additional usage time regarding the deal. The part regarding the agreement is crucial for the payment process because it creates vagueness and affects the choice behavior. Pack C also represents financial YETA, allowing the energy trade option but nothing else. It is a new concept for Türkiye, so participants have doubts about choosing it.
The results are peerless to understanding steel producers' behavior and demand. Depending on them, policy suggestions are made in this research, and they will affect the sector's future, Türkiye's commercial relations, and, most notably, climate change. The summary of the attributes and levels is in Table 5.3 and the summary of the relationship between all agents is in Figure 5.1.

Attributes	Description	Levels
Price Difference (PRICE)	Price differences between the regular and the renewable energy in kr (Turkish penny)/kWh.	8.5kr, 33.8kr, 67.6kr, 83.2kr, 101.4kr, 135.2kr
Price Guarantee (GUAR)	Price guarantee indicates the duration of use in the tariff prices applied when you decide to use renewable energy.	3 month*, 6 month, 9 month, 12 month
Energy Mix (MIX)	Energy mix aims to measure how much renewable energy that companies want to use as a percentage during the transition to renewable energy.	30% Renewable energy & 70% Regular energy; 50% Renewable energy & 50% Regular energy; 70% Renewable energy & 30% Regular energy; 100% Renewable energy*
Payment Process (PACK)	Three payment packages, each with different benefits, are offered for the fourth attribute, "payment process." Here, it will be analyzed what steel producers are willing to pay for renewable energy.	Pack A*, Pack B, Pack C

Table 5.3. Attributes and Levels

Figure 5.1. Relationship between All Agents



Source: Prepared by the Author

We have six levels for price difference attribute: 8.5kr, 33.8kr, 67.6kr, 83.2kr, 101.4kr, 135.2kr. These price levels are determined according to the Green Tariff and the difference between regular and renewable electricity prices published quarterly by the EPDK in Türkiye. While the Green Tariff price excluding taxes, funds, and shares, approved by EPDK and applied as of July 1, 2022, is 262.2851 kr/kWh, the regular electricity price is 245.3607 kr/kWh. In addition to the levels we consider as multiples of these two price differences, we have added the option of 83.2 kr/kWh to equalize CBAM payments. Since carbon prices and exchange rates are constantly changing, all these calculations are made by taking the average of the relevant month for the EU carbon price and exchange rate while considering the confidence interval.

Levels of the second attribute are three, six, nine, and 12 months. While determining these ranges, changes in EPDK tariff prices every three months were considered. The energy mix attribute has four levels: 100% renewable energy, 50% renewable energy & 50% regular energy, 30% renewable energy & 70% regular energy, and 70% renewable energy & 30% regular energy. This attribute proposes a solution where a complete transition to renewable energy is not preferred. Before explaining the packages of the last attribute, we should focus on the Green Tariff and Renewable Energy Guarantees of Origin System (YEK-G) mechanisms in Türkiye. Consumers who want to supply energy within the Green Tariff application determined by the EPDK use the energy produced from environmentally friendly renewable resources and are exposed to a different tariff pricing. The YEK-G System is aimed at expanding the use of renewable energy sources. Participants who want to participate in the YEK-G system must pay an "Annual Participation Fee" of 500 Turkish Liras. In this study, we have prepared three payment packages, and detailed information about the packages can be seen in Table 5.4.

Attributes	Package A	Package B	Package C
System Usage Fee	500 TL	✅ (price varies depending on the deal)	-
Energy Trading	-	-	✅
Additional Usage Time	-	✅	-

Table 5.4. Payment Packages

Package A has a system usage fee of 500 TL per year. The system usage fee represents the admission price in some payment packages. Apart from this, it does not include additional usage time or energy trading opportunities. Package B offers a system usage fee and additional usage time, depending on the agreement between the parties, but lacks the possibility of energy trading. The energy trading option provides the trade opportunity between different markets. Finally, Package C only provides energy trading. These three packages are adapted from the European, American, and Turkish Green Tariff System. As a result of the analysis, it is aimed to reveal which system is more suitable for the steel industry in Türkiye. Participants are asked to consider these explanations when making their choices at the end of this section. After deciding how many attributes and levels, "it is necessary to design a statistically efficient subset of possible alternative combinations" (Bateman et al., 2003).

The complete factorial design includes this study's 288 (6*4*4*3) possible decision situations. However, it is only possible to use some of these choice sets; therefore, unrelated effects must be eliminated. For this, we created an orthogonal design in SPSS Package 28. Orthogonal design is a technique to examine the valuation of the participant's choice behavior. Statistically, it simply means that all independent variables are uncorrelated, and it defines the importance of the attributes and the preferred attribute. SPSS selects the minimum number of cards for given attributes and levels, and these are generated with an orthogonal design option. The process began with entering factor names and labels and defining values. Every set in the orthogonal design represents the different versions of the subject, renewable energy in this case. After completing the generation, SPSS prepares the orthogonal plan about how many cards are successfully generated. It should select the display design option to see detail, and then SPSS creates card lists. Each of these must be realistic and reasonable because, as Bateman et al. (2003) point out, while orthogonality is a desirable feature in the design of a choice task, there are also practical reasons to depart from it. After the orthogonal design process in SPSS, there are 32 profile cards for this research.

After completing all these steps, randomly selected profiles were created. There are eight choice experiment questions with sixteen profile cards in “Questionnaire 1.” Although “Questionnaire 2” has eight choice experiment questions with sixteen profile cards, these differ from “Questionnaire 1.” The fourth section of the questionnaire proposes support mechanisms that the government can undertake to help to export firms switch to renewable energy consumption and minimize carbon payments. Eight support mechanisms were presented in the survey. These are tax reduction, payment convenience, advertising, marketing, data sharing, the price difference between regular and renewable energy, allocating resources from the environmental contribution, and government support. Each of them is designed to encourage the transition to renewable energy. Tax reduction policies may reduce the tax burden of companies. Payment convenience aims to alleviate the costs that will occur in the new system, to which companies are transitioning, to some extent, with payment diversity. Advertising activities can increase the awareness and prestige of the companies. The marketing mechanism offers an opportunity to create new network possibilities and business activities by sharing information. The data-sharing aims to create a group and data provided by the government with companies. The sixth mechanism provides a minor difference between regular and renewable energy prices. Next is allocating resources from the environmental contribution. The last one is government support.

The final part of the questionnaire is about time preference. It is known that with the CBAM, a carbon tax payment will be made for all CO_2 emissions that occur during the production process of any product. With this mechanism, it is predicted that mainly exporting companies will be affected in Türkiye, and the demand for transition to renewable energy will accelerate. We discuss the preferences between paying later but a higher amount due to carbon tax by choosing regular energy or paying now a higher price for renewable energy but no payment for tax. Regular energy leads to climate change but is cheaper than renewable energy. Therefore, it was analyzed whether the participant prefers using renewable energy, which is now more expensive but eventually cheaper.

5.2. Experiment Size

The steel industry significantly impacts climate change due to its high carbon emissions. Despite the developments of production methods over the years, it is still one of the highest carbon-intense industries. The fact remains that the EU's concrete step, CBAM, has a surcharging carbon payment on selected imported goods to the EU. According to this mechanism, five sectors should start as quickly as possible to transition to renewable energy. The steel industry is one of these five industries. Therefore, it is crucial to curb the harmful effects of climate change and sustain commercial relationships with the EU.

In addition to these industrial improvements, there is a fact that Türkiye is one of the ten crude steel producer in the world. At the same time, most EU countries, such as Germany, Italy, and Spain, are Türkiye 's steel export partners. Due to the demand for the RE transition and the importance of the issue, we decided to investigate the demand and behavior of crude steel producers in Türkiye. There are forty crude steel plants in Türkiye. These facilities have different production techniques, such as a basic oxygen furnace (BOF), an electric arc furnace (EF), and an induction furnace (IF). While three plants use BOF technology, eleven use IF, and the remaining twenty-six use EF. Table 5.5 shows an overview of crude steel plants and their production techniques.

On the other hand, crude steel plants can be categorized into capacities by ton/year. Eleven plants have 2.000.001 and above ton/year capacities. Seven have 1.000.001-2.000.000 ton/year capacities, nine have 501.000-1.000.000 ton/year, and thirteen have 50.000-500.000 ton/year capacities.

Production Technology	Frequency
EF	26
IF	11
BOF	3

Table 5.5. Crude Steel Plants and Production Techniques

In this experiment, there are sixteen respondents among the forty plants. While six respondents have 2.000.001 and above ton/year capacities, four have 1.000.001-2.000.000 ton/year, another four have 501.000-1.000.000 ton/year, and two have 50.000-500.000 ton/year capacities. 55% of the Turkish steel producers with a capacity of 2,000,001 tons/year and above and 57% of the Turkish steel producers with a capacity of 1,000,001-2,000,000 tons/year participated in the questionnaire. On the other hand, 44% of Turkish steel producers with a capacity of 501,000-1,000,000 tons/year and 15% of Turkish steel producers with a capacity of 50,000-500,000 tons/year answered this study.

Capacities of Turkish Steel Producers (ton/year)	Total Numbers of Steel Producers in Türkiye (Frequency)	Numbers of Steel Producers Included in the Questionnaire (Frequency)	Percentage of Questionnaire Steel Producers in Total Steel Producers (Percentage)
50,000 - 500,000	13	2	15%
501,000 - 1,000,000	9	4	44%
1,000,001 - 2,000,000	7	4	57%
2,000,001 and above	11	6	55%

Table 5.6. Steel Producers' Capacities and Frequencies.

A vital feature of the experiment is that the respondents are from one of the highest levels of capacities among the forty-producing plants. On the other hand, the participants, who are managers, engineers, or owners, have decision-making power and knowledge about the subject to prevent risk perception. Once the final version of the questionnaire was completed, we met with the steel producers to explain this experiment. Also, participants were informed about the DCE and the purposes of the research. After the meeting, data-collecting activities were started and conducted between August 2022 and October 2022. Although a small number of companies are in this industry, Türkiye has colossal export power for steel, and at the same time, it is in the top 10 producers worldwide. Therefore, this is essential information for the experiment, although the industry is small.

CHAPTER VI

ANALYSIS AND RESULTS

6.1. Descriptive Analysis

For the empirical analysis, the data were collected from steel producers in Türkiye. There are forty plants in Türkiye, and they all have different production capacities in terms of tons/year, as mentioned. Before the questionnaire was conducted, we held a renewable energy meeting on 18 August 2022 to explain the rationale behind this research to the Turkish Steel Producers Association members. Due to the small sample size of the producers, it is crucial to explain the questions asked to the producers in detail for a correct understanding of the study. Twenty-seven companies could be contacted, and sixteen of the forty companies participated in the research. While 37.5% of the steel producers are in the range of "2.000.001 and above" tons/year, 25% are in the capacity of "1.000.001-2.000.000" and "501.000-1.000.000" tons/year in the questionnaire data that we held. The remaining 12.5% is on this analysis's "50.000 – 500.000" ton/year scale.

On the other hand, the electricity usage of the participant steel producer firms is shown in Table 6.2. According to the results, 75% of participants use "1000 mWh and above", and 18.75% use "801-999 mWh" electricity daily for their production. The questionnaire contains general questions about the company and its perspectives on the renewable energy transition. Two questionnaire versions are sent randomly, and the choice sets are presented randomly. The participants were selected from professionals from steel producer companies.

Capacities of Turkish Steel Producers (ton/year)	Total Numbers of Steel Producers in Türkiye (Frequency)	Numbers of Steel Producers Included in the Questionnaire (Frequency)
50,000 - 500,000	13	2
501,000 - 1,000,000	9	4
1,000,001 - 2,000,000	7	4
2,000,001 and above	11	6

Table 6.1. The Firms and The Questionnaire Scale Steel Producers' Data

Electricity Usage in the Production Process	Frequency	Percentage
1 - 200 mWh	1	6.25%
201 - 400 mWh	-	0.00%
401 - 600 mWh	-	0.00%
601 - 800 mWh	-	0.00%
801 - 999 mWh	3	18.75%
1000 mWh and above	12	75.00%

Table 6.2. Electricity Usage

Descriptive statistics of this research were completed in STATA. According to the result of sex, 100% of participants are male. The average age is approximately 48 years, and 81.25% of participants have a Bachelor's degree or more (see Table 6.3).

Education Level	Frequency	Percentage
College	3	18.75%
Bachelor's degree	9	56.25%
Master's degree	3	18.75%
Doctor's degree	1	6.25%

Table 6.3 Education Level

University Department	Frequency	Percentage
Electrical & Electronics Engineering	5	31.25%
Mechanical Engineering	3	18.75%
Environmental Engineering	3	18.75%
Metallurgical & Materials Engineering	4	25.00%
Other	1	6.25%

Table 6.4. University Department

The participants' qualifications are fundamental for this research, as the decision-makers need to answer the questions about the transition to renewable energy. While 93.75% of attendants had engineering titles in different disciplines (see Table 6.4), 87.5% of the sampled participants were in managerial or higher-level positions, and the remaining 12.5% worked as engineers in their companies (see Table 6.5).

Professional Position	Frequency	Percentage
Member of Board	1	6.25%
General Manager	2	12.50%
Manager	11	68.75%
Engineer	2	12.50%

Table 6.5. Professional Position

The questionnaires have different questions to understand the participants' choice behavior. While one of the types asks questions about attributes' importance directly, another asks questions in the choice experiment methodology. The aim is to reveal actual choice behaviors. Directly asking attribute importance questions have six choices: it does not have any importance, it is not essential, neutral, important, very important, and not considered. The highest percentage of the attribute importance belongs to the energy mix attribute, 56.25% of the "very important" option. While price difference and payment process are well taken as "important," price guaranty and energy mix attributes are mostly "very important" (see table 6.6).

Attribute Importance (Percentage)	Price Difference	Price Guaranty	Energy Mix	Payment Process
It doesn't have any importance	-	-	6.25%	-
It is not important	6.25%	-	-	18.75%
Neutral	-	6.25%	6.25%	6.25%
Important	50.00%	31.25%	25.00%	31.25%
Very important	31.25%	50.00%	56.25%	18.75%
Not considered	12.50%	12.50%	6.25%	25.00%

Table 6.6. Attribute Importance in Terms of Percentage

Another important fact is that although Türkiye is one of the top ten countries in the world in terms of steel production and the sector emits an enormous level of CO_2, there is still a lack of renewable energy usage in the Turkish steel industry (TÇÜD, 2023). Also, with CBAM implementation, transitioning to renewable energy is essential to sustain commercial relations with the EU, one of the biggest markets for Turkish exports. In this research, all but one of the participants responded about annual export levels and EU export levels (See Tables 6.7 and 6.8).

Export Level	Frequency	Percentage
0 - 25%	6	37.50%
26 - 50%	3	18.75%
51 - 75%	5	31.25%
76 - 100%	1	6.25%

Table 6.7. Export Level (annual)

EU Export Level	Frequency	Percentage
0%	6	37.50%
25%	6	37.50%
50%	1	6.25%
75%	-	0.00%
100%	-	0.00%
Other	2	12.50%

Table 6.8. EU Export Level (annual)

To examine renewable energy behaviors, are asked to choose one of the scales from "I strongly disagree" to "I strongly agree." There are four sentences that perceptions about the future Sentence 1 states, "We will increase the usage of renewable energy until 2053," and 15 participants responded to this section. While 87.5% of the participants stated that they "Strongly agreed" with the increase in renewable energy usage, only one said "Neutral." (see Table 6.9)

We will increase the usage of renewable energy until 2053					
Level	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
Frequency	-	-	1	-	14
Percantage	0.00%	0.00%	6.25%	0.00%	87.50%

Table 6.9. Renewable Energy - Sentence 1

Sentence 2 states, "We will increase the investments in renewable energy until 2053". All participants responded to this section. While 93.75% of the participants stated that they "Strongly agree" with the increase in renewable energy investments, only one participant said "Neutral." (see Table 6.10).

We will continue our work just like now; we will not change anything until 2053.					
Level	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
Frequency	11	-	1	-	1
Percantage	68.75	0.00%	6.25%	0.00%	6.25%

Table 6.10. Renewable Energy - Sentence 2

Sentence 3 states, "We will decrease the CO_2 emission of our company until 2053". All participants responded to this section. While 87.50% of the participants stated that they "Strongly agree," one participant said, "I agree," and the other was "Neutral" (see Table 6.11).

We will increase the investments in renewable energy until 2053					
Level	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
Frequency	-	-	1	-	15
Percantage	0.00%	0.00%	6.25%	0.00%	93.75%

Table 6.11. Renewable Energy - Sentence 3

Sentence 4 states, "We will continue our work just like now; we will not change anything until 2053". 13 participants responded to this section. While 68.75% of the participants stated that they "Strongly disagree," one participant said, "I strongly agree," and another was "Neutral" (see Table 6.12).

We will decrease the CO2 emission of our company until 2053					
Level	**I strongly disagree**	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
Frequency	-	-	1	1	14
Percantage	0.00%	0.00%	6.25%	6.25%	87.50%%

Table 6.12. Renewable Energy - Sentence 4

The government support mechanism section proposes some policy options that the government can undertake to support steel producers' transition to renewable energy. There are eight mechanisms in the questionnaires, and they aim to increase the renewable energy consumption of steel producers in Türkiye. The highest percentages in the "strictly useful" section are government support, tax reduction, and easy payment terms. 93.75% of the participants chose easy payment, either useful or strictly useful. At the same time, 87.5% of stated tax reductions, low price differences, and government support are useful or strictly useful policies (see Table

6.13). Contrastly, advertisement, marketing, or data-sharing suggestions are the least valued mechanisms among steel producers during the transition to renewable energy.

Government Support Mechanism						
Frequency	Strictly Useful	Useful	Neutral	Useless	Strictly Useless	Other
Tax reduction	9	5	-	-	2	-
Easy terms of payment	8	7	1	-	-	-
Advertisement	4	5	4	3	-	-
Marketing	4	4	4	3	-	-
Data sharing	4	4	3	3	2	-
Low price difference	7	7	1	-	1	-
Resource from environmental contribution	6	6	2	-	2	-
Government support	10	4	-	-	2	-
Other	-	-	-	-	-	2

Table 6.13. Government Support Mechanism in Terms of Frequency

Government Support Mechanism						
Percentage	Strictly Useful	Useful	Neutral	Useless	Strictly Useless	Other
Tax reduction	56.25%	31.25%	-	-	12.50%	-
Easy terms of payment	50.00%	43.75%	6.25%	-	-	-
Advertisement	25.00%	31.25%	25.00%	18.75%	-	-
Marketing	25.00%	25.00%	25.00%	18.75%	-	6.25%
Data sharing	25.00%	25.00%	18.75%	18.75%	12.50%	-
Low price difference	43.75%	43.75%	6.25%	-	6.25%	-
Resource from environmental contribution	37.50%	37.50%	12.50%	-	12.50%	-
Government support	62.50%	25.00%	-	-	12.50%	-
Other	-	-	-	-	-	13.00%

Table 6.14. Government Support Mechanism in Terms of Percentage

The last part was called “Time Preference.” It aims to analyze whether to be willing to pay a lower cost now and then a higher price for the energy in the uncertainty. This sentence also refers to the choice between using regular energy and paying less with a massive carbon tax payment later or using renewable energy now and paying more but less carbon tax later. According to the questionnaire results, participants tend to switch to renewable energy when the tax assumption is 600 TL & 700 TL per ton, depending on the CO_2 emissions. Their preference to switch tends to decrease when the tax assumption is low. While column 0% represents that the participant producers do not want to switch to the RE, 100% represents that respondents want to switch to RE 100% (Table 6.15).

Tax Assumption per ton CO2 (Frequency)	0% (do not want to switch)	25%	50%	75%	100% (want to switch)
400 TL	-	1	4	-	8
500 TL	-	-	3	3	7
600 TL	-	-	-	4	5
700 TL	-	-	-	1	11

Table 6.15. Time Preference in Terms of Frequency

6.2. Econometric Analysis

6.2.a. The Model

The DCE methodology reveals hypothetical decision-making situations through attribute-based preferences (Danne et al., 2021). Therefore, DCEs are vital to providing recommendations to policymakers about the transition to renewable energy (Danne et al., 2021). Likewise, according to Hanley et al. (2003), this methodology provides accurate WTPs, which is another vital fact for giving recommendations to policymakers. The crucial step is the model selection and WTP estimation in the DCEs. The following estimated model aims to reveal the values of renewable energy components. Definitions of the variables in the model can be seen in Table 6.16.

As discussed in section 4, there are four attributes in this choice experiment: price difference(price), price guarantee(guar), energy mix(mix), and payment packages (Pack). The payment package attribute has three options: Pack A, Pack B, and Pack C, and it is the only dummy variable for the model. Pack B was dropped as the baseline variable, and the model includes only Pack A and Pack C.

The random parameter logit model was estimated by NLOGIT 4. For the signs of the attributes, while we expect a negative sign for the price difference attribute, we await a positive one for the rest. In addition to that, factors such as education level, export level, and capacities did not significantly impact the decision-making toward the transition to renewable energy. Hence, they were not considered in the models' estimations. Another essential point is the measurement of the model's explanatory power. To prove that, Pseudo-R^2 using as a goodness-of-fit measure. According to

(Hensher, Rose, and Greene 2005), a Pseudo-R^2 of at least 0.3 represents an appropriate model fit (Danne, Meier-Sauthoff, and Musshoff 2021). In this research, McFadden Pseudo-R^2 was used for RPM, which is 0.4897 in this research.

$$V = STQU + \beta_1 PRICE + \beta_2 GUAR + \beta_3 MIX + \beta_4 PACKA + \beta_5 PACKC$$

Variable	Definition
PRICE	"PRICE" represents the price difference between renewable and regular energy in all models.
GUAR	"GUAR" represents the price guarantee in terms of months in all models.
MIX	"MIX" represents the opportunity to choose the amount of renewable energy you can pass on in all
PACK A	"PACK A" is one of the payment packages. It includes only the system usage fee.
PACK C	"PACK C" is one of the payment packages. It includes only the energy trade option.
STQU	"STQU" is constant term.

Table 6.16. Variables and Definitions

6.2.b. Results

The following section provides an overview of the impact of CBAM on Turkish steel producers' demand and behavior toward renewable energy. Initially, the participants were asked general questions about the company, and the rest of the questions were to understand their perspectives on the renewable energy transition. The general questions about the firm include scale, current renewable energy usage, regular energy usage, annual export levels to the EU, and yearly export levels. Participants' general questions include their education level, the university department they graduated from, professional position, age, and gender. After these questions, there are four sentences about reducing CO_2 emissions, renewable energy investments, increasing usage of renewable energy, or staying the same to understand their behavior for the future. Then, respondents revealed their preferences for Government Support Mechanisms. According to these preferences, 87.5% stated that tax reduction, low price difference, and government support are "useful" or "very useful" policies. On the other hand, advertisement, marketing, or data-sharing suggestions are at least valued mechanisms among steel producers during the transition to renewable energy.

In the next part, participants exposed their choices about Time Preferences. These questions aim to analyze the participants' preferences when the tax payment time and amount change. The section also refers to the choice between using regular energy and paying less with a massive carbon tax payment later or using renewable energy and paying more now but less carbon tax later. The results showed that participants tend to switch to renewable energy when the expected carbon tax is 600 TL & 700 TL per ton, depending on the CO_2 emitted. When the tax assumption is low, their preference to switch also decreases. Finally, given alternatives, participants choose one of two profiles or none in a discrete choice experiment. The estimation results of the random parameter logit model are presented in Table 6.17. The coefficients on all attributes are significant except for Pack C. For the signs of the attributes, we expect that the price difference has a negative sign, but the rest has a positive, which is consistent with our results. For instance, the price coefficients are negative and statistically significant at a 1% significance level. This result shows that as the price difference level increases, the attractiveness of the switching RE decreases.

Contrastly, the price guarantee and energy mix attributes are positive and statistically significant at 10% and 5%, respectively. While Pack A is statistically significant at a 5% significance level, Pack C is insignificant. The dummy variables are interpreted by comparison to the dropped baseline variable. Hence, an insignificant result means that the attractiveness of Package C is no different from Package B. However, a positive and significant result (Pack A) means Pack A is valued more than Pack B by WTP's estimated amount. The levels of significance and the coefficients of attributes with price are crucial to calculating MWTP. For a unit increment of the x attribute, the MWTP is calculated as follows:

$$MWTP_x = \frac{dp}{dx} = -\frac{\frac{\partial V}{\partial x}}{\frac{\partial V}{\partial p}} = -\frac{\beta_x}{\beta_p}$$

or

$$MWTP = -\frac{\beta_{Characteristic}}{\beta_{Price}}$$

	Model
PRICE	-0.058*** (0.019)
GUAR	0.194* (0.101)
MIX	0.044** (0.019)
PACK A	1.039** (0.492)
PACK C	0.743 (0.670)
STQU	-7.994*** (2.264)
McFadden Pseudo-R^2	0.4897
Number of observations	123
LogL	-68.953

Table 6.17. Estimated Coefficients of Random Parameter Logit Model

***, ** and * indicate that the parameter is significant at 1%, 5% and 10% level respectively. Figures in parentheses are standard errors.

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MWTP is derived from the random parameter logit model in this research. While a positive MWTP implies that it is an attractive option and participants are willing to pay a positive amount for a unit of good or service, a negative result indicates that the feature is not attractive to steel producers. WTP estimations place monetary values on the attractiveness of each attribute. We assumed that the energy consumption is 1000 mWh per day, so MWTP is multiplied by 10^4 in Table 6.18 to turn the results into the TL. The MWTP indicates how much people are willing to pay when each attribute increases by one unit. One unit for each attribute is one month for price guarantee, 1% for energy mix, and package comparisons.

(TL/mWh)	The Model
GUAR	33,448*
MIX	7,586**
PACK A	179,138**
PACK C	128,103

Table 6.18. MWTP Results

$$\left[\ \mathbf{MWTP_X} = \left(-\frac{\beta_X}{\beta_{Cost\ per\ kWh}}\right)10^4\right]$$

Bold numbers refer to significance. ***, ** and * indicate that the parameter is significant at 1%, 5% and 10% level respectively.

According to our results, the value of an additional month of price guarantee period has been estimated as 33,448 TL (1,858 EUR since we consider 1 EUR= 18 TL), and the value of a 1% increase in renewable energy in the energy mix of the supplied energy has been calculated as 7,586 TL (421.44 EUR since we consider 1 EUR= 18 TL). Besides, the attractiveness of Package A is monetized as 179,138 TL (9,952 EUR since we consider 1 EUR= 18 TL) more than Package B's. This thesis also points out the attractiveness of RE increased as the price guarantee period increased. Participants give a value extending the price guarantee period by one month, equivalent to 20% of the current price difference. The price difference between regular and renewable energy is 16.9244 Turkish cents, and it is 169.244 TL for the 1000 mWh. 1 month's extension of the price guarantee almost equals about 20% of the price difference, which is 33,848 TL. Hence, we can conclude that the attractiveness of RE transition increases as the period of price guarantee increases, and the one-month extension compensates for 20% of the price difference.

On the other hand, there is a difference between actual payment and willingness to pay regarding RE; the respondents attach more value to renewable energy than its current price. For an additional 1% increase in renewable energy in the energy mix of the supplied energy, firms are willing to pay an extra 7,586 TL. Given that 100% renewable energy costs 16.9244 Turkish cents more today, willingness to pay 0.7586 Turkish cents per 1% of renewable energy means that firms are willing to pay 75.86 Turkish cents for 100% renewable energy.

Package A, with a fixed and certain usage fee, is preferable to Package B or Package C. The findings of Salm et al. (2016) and this research are similar to the participants preferring simple paybacks or simple packages in this study. Package B has a system usage fee and additional usage time that depends on the parties. On the other hand, Package C has only the energy trade option. The results show that the energy trade option, additional usage time depending on the parties, and system usage fee are not attractive for the participant steel producers.

We can also interpret MWTP results in a different way: for example, we take choice set 4 and profile 1 in Questionnaire 1. Considering the MWTP results, for a 9-month price guarantee, 50% RE, and Pack A, the respondents are willing to pay 859,470 TL. On the other hand, when they decide to switch to RE, their gain is 646,608 TL[3], as we mentioned earlier. Therefore, the participating Turkish steel producers are willing to pay almost 33% more than the daily gain of their earnings when switching to RE.[4] Finally, we can expound that the participant Turkish steel producers tend to switch to RE and are willing to pay more than its actual price.

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[3] See Table 5.2.

[4] Total WTP for Choice set 4-Profile one as follows: ((9*33,448) + (50*7,586) + (179,138)) = 859,470 TL

CHAPTER VII

DISCUSSION AND POLICY RECOMMENDATION

The result indicating that the green tariff should guarantee the price for a longer time is significant. It suggests that stability and predictability of prices are essential factors for Turkish steel producers when considering the adoption of green energy. This finding highlights the need for energy providers to offer green electricity tariffs with price stability to meet the demands and preferences of consumers, which can ultimately promote the uptake of renewable energy sources. Also, our findings suggest that energy providers should consider offering simple and transparent green energy tariffs to meet the preferences and needs of consumers. The respondents may need help understanding the complexities of energy trading or the implications of additional usage time and prefer a more straightforward pricing structure. Finally, the willingness of steel producers to transition to renewable energy sources presents an opportunity for governments to support and accelerate the adoption of green energy in the steel industry. By providing financial incentives, regulatory support, and technical assistance, governments can help steel producers overcome the barriers to adopting renewable energy and promote decarbonization. This transition can contribute to achieving national and international climate goals and help create a more sustainable future for the steel industry. As the WTP involves the savings accrued from CBAM payments and the subsequent reduction in emissions from energy generation, it can be posited that this contributes to the overall increase in social welfare.

Chassot et al. (2014) work on investors' perceptions revealed that investors' worldviews play an important regulatory role. Goett et al. (2000)'s study sought to identify the preferences of small/medium commercial industrial consumers. Lüthi and Wüstenhagen (2012) quantified the "cost of policy risk" with this research, claiming the importance of "non-economic" barriers to renewable energy use. Salm et al. (2016) examine the participating energy investors who made decisions based on simple payback calculations or intuition rather than complex analyses.

On the other hand, Danne, Meier-Sauthoff, and Musshoff (2021) performed a DCE on households. The results showed that the green energy source mainly influences consumers' decisions. Similarly, Oluoch et al. (2021) and Bae, Rishi, and Li (2021) also investigated consumer preferences with the DCE methodology.

To summarize, DCEs aim to simulate real-world decision-making scenarios. Researchers can assess their relative importance by systematically varying these attributes and understanding how individuals weigh different attributes when making choices. By selecting a representative sample and ensuring the attributes and levels are relevant to the research context, DCEs can provide valuable insights into the preferences and choices of the target population. It is important to note that while DCEs are considered reliable, research methodology has limitations. This predictive power is valuable for market forecasting, policy impact assessment, and decision support. Therefore, this thesis contributes to the literature by applying the previous literature's DCE methodology and doing it on a new group for such an important topic: climate change.

CHAPTER VIII

CONCLUSION

As the effects of climate change have become increasingly visible, it is necessary to research these effects and design policies to prevent them. Among the crucial steps to address this issue is adopting renewable energy sources to reduce CO_2 emissions. Considering that the steel industry is one of the most significant contributors to global CO_2 emissions and that Türkiye ranks among the top ten steel producers worldwide, it is essential to analyze the demands and behaviors of Turkish steel producers to address the potential impact of CBAM and climate change on Türkiye. Therefore, this thesis examines Turkish steel producers' demand and behavior toward renewable energy in Türkiye. The research conducted a DCE to determine the Turkish steel producers' MWTP and preferences for the renewable energy transition. The findings revealed that the attractiveness of transitioning to renewable energy increased as the price guarantee period lengthened, indicating that participants assigned more significant value to renewable energy than its current price. Moreover, Turkish steel producers preferred fixed and specific payment packages as incentives for transitioning to renewable energy. Consequently, this research discusses the potential roles the Turkish government could undertake to facilitate this transition, reduce the carbon footprint of steel producers, and promote the supply of renewable energy.

The insights gained from this study provide valuable perspectives for policymakers regarding the influence of CBAM on the steel sector and the demands of steel producers. This knowledge explores the Turkish government's potential role in facilitating the transition of firms towards renewable energy, reducing their carbon emissions, and promoting the growth of renewable energy sources. The research also provides insights into how government policies can support and encourage the adoption of renewable energy by steel producers in Türkiye. Crucially, it is vital to determine the price differences between regular and renewable energy; price guarantees and fixed payment packages are preferable by

Turkish steel producers. Aligning policies with the preferences of Turkish steel producers is of utmost significance in mitigating the impacts of climate change and maintaining Türkiye's international trade relations. Adopting such policies would enhance the country's competitiveness by enabling firms to align with the global trend toward sustainability and environmentally friendly practices.

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APPENDIX

THE QUESTIONNAIRE

ANKET-1

Bu anket TOBB Ekonomi ve Teknoloji Üniversitesi İktisat Bölümü yüksek lisans öğrencisi Aylin İngenç tarafından "Sınırda Karbon Düzenleme Mekanizması'nın Türkiye'deki Firmaların Yenilenebilir Enerjiye Yönelik Talep ve Davranışlarına Etkisini" ölçmek amacıyla tasarlanmıştır. Bu araştırma, karbon vergisinden etkilenebilecek şirketlerin yeşil enerjiye geçiş konusundaki algılarını, potansiyel davranışlarını ve tercihlerini analiz etmeyi amaçlamaktadır. Sonuçlar, yeşil enerjiye geçiş sürecini kolaylaştıracak ve firmaları teşvik edecek politika önerileri yapmak için kullanılacaktır. Ankete ilişkin verilen cevaplar sadece akademik araştırma amacıyla kullanılacak ve yapılan analizin sonuçları kamuoyu ile paylaşılacaktır, ancak hiçbir kimlik veya şirket bilgisi kamuoyuna sunulmayacaktır. Anketin sağladığı verilerle gerçekleştirilecek çalışmanın sonuçların sizinle paylaşılmasını isterseniz, lütfen en arka sayfaya iletişim bilgilerinizi yazınız. Anket yaklaşık olarak 15 dakika sürecektir.

Genel Sorular

1- Şirket içerisindeki profesyonel pozisyonunuz nedir?

Şirket Sahibi	Yönetim Kurulu Üyesi	Genel Müdür	Müdür	Mühendis	Uzman

2- Eğer yenilenebilir enerji kullanıyorsanız elektrik tüketiminizin yüzde olarak ne kadarı yenilenebilir enerjiden sağlanıyor?

0%	25%	50%	75%	100%	Diğer

3- Aşağıdaki önermeleri şirketiniz için 1-5 arasında değerlendiriniz.

(1-Kesinlikle Katılmıyorum, 2-Katılmıyorum, 3-Nötr, 4-Katılıyorum, 5-Kesinlikle Katılıyorum)

	1	2	3	4	5
2053 yılına kadar yeşil enerji kullanımımızı arttıracağız.					
2053 yılına kadar yenilenebilir enerji konusunda yatırımlarımızı arttıracağız.					
2053 yılına kadar şirketimizin CO2 emisyonunu azaltacağız.					
2053 yılına kadar çalışmalarımıza aynı şekilde devam edeceğiz herhangi bir değişiklik olmayacak.					

4- Şirketinizin üretim sürecinde her gün ne kadar elektrik kullanıyorsunuz?

1-200 MWh	
201-400 MWh	
401-600 MWh	
601-800 MWh	
801-999 MWh	
1000 MWh üzeri	

5- Yıllık üretiminizin yüzde kaçını ihraç ediyorsunuz?

0-25%	26-50%	51-75%	76-100%

6- Yıllık üretiminizin yüzde kaçını Avrupa Birliği’ne ihraç ediyorsunuz?

0%	25%	50%	75%	100%	Diğer

Demografik Sorular

1- Yaşınız ____________________

2- Cinsiyetiniz

Kadın	Erkek	Belirtmek İstemiyorum

3- Eğitim Seviyeniz

İlkokul	Ortaokul	Lise	Ön Lisans	Yüksekokul	Lisans	Yüksek Lisans	Doktora

4- Üniversite mezunu iseniz hangi bölümden mezun olduğunuzu lütfen yazınız.

____

5- Mesleğiniz

Makina Müh.	Elektrik & Elektronik Müh.	Çevre Müh.	Mühendis (Diğer)	Danışman	Yönetici	Üst Düzey Yönetici	Şirket Sahibi	Diğer (Belirtiniz)

Seçim Deneyi Soruları

Bu bölümde katılımcıya iki farklı profil sunulmakta ve katılımcının yenilenebilir enerji kullanımı konusunda şirket adına karar verici olduğunu düşünerek bir profil seçmesi beklenmektedir. Profilin içinde 4 özellik vardır.

1- Birinci özellik olan "fiyat farkı", normal enerji ile yenilenebilir enerji arasındaki fiyat farkını kr/kwh cinsinden göstermektedir. Yenilenebilir enerji; güneş, rüzgâr, jeotermal, hidroelektrik, biyokütle, hidrojen ve dalga enerjisi gibi doğal kaynaklardan elde edilir. Fiyat farkının daha iyi anlaşılması açısından aşağıdaki örneği inceleyebilirsiniz.

Yenilenebilir Enerji Fiyatı (kr/KWh)	Nihai Enerji Fiyatı (kr/KWh)	Yenilenebilir Enerji & Nihai Enerji Fiyat Farkı (**TL**/kWh)	1 ton CO_2 başına ödenecek ekstra elektrik fiyatı (Yenilenebilir & nihai enerji fiyat farkı * sera gazı dönüşüm katsayısı) (TL)	Yenilenebilir Enerjiye Geçilmezse Ödenecek Karbon Vergisi (TL)	Yenilenebilir Enerjiye Geçilirse Ton CO2 Başına Sağlanan Kazanç (TL)
262,2851	245,3607	0,169244	304,94	1.470	1.165

Günde 1000 MWh elektrik tüketen bir firma varsayalım;

1 ton CO_2 başına ödenecek ekstra elektrik fiyatı (Yenilenebilir & nihai enerji fiyat farkı * sera gazı dönüşüm katsayısı) (TL)	Yenilenebilir enerjiye **geçilirse** günlük ödenecek ekstra fiyat (TL)	Yenilenebilir enerjiye **geçilmezse** günlük ödenecek karbon vergisi fiyatı (TL)	Yenilenebilir enerjiye geçilirse günlük 1000 MWh elektrik tüketiminden elde edilen kazanç (TL)
304,94	169.242	815.850	**646.608**

Bu firmanın yenilenebilir enerjiye geçmesi durumunda elde edeceği kazanç günlük 646.608 TL'dir.

2- İkinci özellik olan "fiyat garantisi" yeşil enerji fiyatlarının geçerli olduğu süreyi göstermektedir. Şu an Türkiye'de uygulanan Yeşil Tarife kapsamında elektrik fiyatları **üç ayda bir** olacak şekilde güncellenmektedir.

3-Üçüncü özellik "enerji karışımı", yeşil enerjiye geçişte kullanılacak enerjinin % olarak ne kadarının yenilenebilir ne kadarının fosil yakıtlar sonucu olan enerjiden sağlanacağını göstermektedir.

Dikkat!! Yakın gelecekte Türkiye'de de uygulamaya başlayacak Sınırda Karbon Mekanizması ile ürünler üretilirken saldığı karbon miktarına göre karbon vergisine maruz kalacak.

4- Dördüncü özellik "ödeme seçeneği" için üç adet farklı paket sunulmuştur. Paketlerle ilgili açıklama yapmadan önce Yeşil Tarife ve YEK-G mekanizmalarını inceleyelim.

Enerji Piyasası Düzenleme Kurumu (EPDK) tarafından belirlenen Yeşil Tarife uygulaması kapsamında enerji temin etmek isteyen tüketiciler çevre dostu yenilenebilir kaynaklardan üretilen enerji kullanırlar ve fiyatlandırma olarak farklı bir tarifeye maruz kalırlar. YEK-G Sistemi ile yenilenebilir enerji kaynaklarının kullanımının yaygınlaştırılması amaçlanmaktadır. YEK-G sisteminde aktif olmak isteyen katılımcıların "Yıllık Katılım Ücreti" olan 500 TL'yi ödemeleri gerekmektedir. Ödeme paketleriyle ilgili detaylı bilgiyi aşağıdaki tabloda bulabilirsiniz.

Özellikler	Paket A	Paket B	Paket C
Sistem Kullanım Bedeli	500 TL	✅(anlaşmaya bağlı olarak fiyat değişir)	-
Enerji Ticareti Olanağı	-	-	✅
Ek Kullanım Süresi	-	✅	-

Paket A, yıllık katılım ücreti olan 500 TL maliyete sahiptir.

Paket B, taraflar arasında yapılan anlaşmaya bağlı bir sistem kullanım bedeli ve ek kullanım süresi sunmaktadır.

Paket C, sadece enerji ticareti olanağı sağlamaktadır.

Seçimlerinizi yaparken lütfen bu açıklamaları göz önünde bulundurunuz.

Aşağıda yenilenebilir enerjiye geçiş için size sunulan iki profilden, özelliklerine ve açıklamalarına dayanarak hangisini seçersiniz?

<table>
<tr><th>1. Özellikler</th><th>Profil 1</th><th>Profil 2</th><th>Hiçbiri</th></tr>
<tr><td>Fiyat Farkı</td><td>83,2 kr</td><td>67,6 kr</td><td rowspan="5">Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.</td></tr>
<tr><td>Fiyat Garantisi</td><td>12 ay</td><td>12 ay</td></tr>
<tr><td>Enerji Karışımı</td><td>%100 Yenilenebilir Enerji</td><td>%30 Yenilenebilir Enerji & %70 Normal Enerji</td></tr>
<tr><td>Ödeme Seçenekleri</td><td>Paket B<table><tr><th>Özellikler</th><th>Paket B</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>✅(anlaşmaya bağlı olarak fiyat değişir)</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>-</td></tr><tr><td>Ek Kullanım Süresi</td><td>✅</td></tr></table></td><td>Paket A<table><tr><th>Özellikler</th><th>Paket A</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>500 TL</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>-</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td></tr>
<tr><td>Tercih</td><td></td><td></td></tr>
</table>

<table>
<tr><th>2. Özellikler</th><th>Profil 1</th><th>Profil 2</th><th>Hiçbiri</th></tr>
<tr><td>Fiyat Farkı</td><td>8,5 kr</td><td>8,5 kr</td><td rowspan="4">Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.</td></tr>
<tr><td>Fiyat Garantisi</td><td>12 ay</td><td>12 ay</td></tr>
<tr><td>Enerji Karışımı</td><td>%70 Yenilenebilir Enerji & %30 Normal Enerji</td><td>%100 Yenilenebilir Enerji</td></tr>
<tr><td>Ödeme Seçenekleri</td><td>Paket C<table><tr><th>Özellikler</th><th>Paket C</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>-</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>✅</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td><td>Paket A<table><tr><th>Özellikler</th><th>Paket A</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>500 TL</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>-</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td></tr>
<tr><td>Tercih</td><td></td><td></td><td></td></tr>
</table>

3. Özellikler	Profil 1	Profil 2	Hiçbiri
Fiyat Farkı	101,4 kr	135,2 kr	Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.
Fiyat Garantisi	6 ay	3 ay	
Enerji Karışımı	%50 Yenilenebilir Enerji & %50 Normal Enerji	%50 Yenilenebilir Enerji & %50 Normal Enerji	
Ödeme Seçenekleri	Paket C Özellikler | Paket C Sistem Kullanım Bedeli | - Enerji Ticareti Olanağı | ✅ Ek Kullanım Süresi | -	Paket A Özellikler | Paket A Sistem Kullanım Bedeli | 500 TL Enerji Ticareti Olanağı | - Ek Kullanım Süresi | -	
Tercih			

4. Özellikler	Profil 1	Profil 2	Hiçbiri
Fiyat Farkı	33,8 kr	8,5 kr	Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.
Fiyat Garantisi	9 ay	3 ay	
Enerji Karışımı	%50 Yenilenebilir Enerji & %50 Normal Enerji	%30 Yenilenebilir Enerji & %70 Normal Enerji	
Ödeme Seçenekleri	Paket A Özellikler | Paket A Sistem Kullanım Bedeli | 500 TL Enerji Ticareti Olanağı | - Ek Kullanım Süresi | -	Paket A Özellikler | Paket A Sistem Kullanım Bedeli | 500 TL Enerji Ticareti Olanağı | - Ek Kullanım Süresi | -	
Tercih			

5. Özellikler	Profil 1	Profil 2	Hiçbiri
Fiyat Farkı	33,8 kr	33,8 kr	Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.
Fiyat Garantisi	12 ay	12 ay	
Enerji Karışımı	%50 Yenilenebilir Enerji & %50 Normal Enerji	%30 Yenilenebilir Enerji & %70 Normal Enerji	
Ödeme Seçenekleri	Paket A Özellikler | Paket A Sistem Kullanım Bedeli | 500 TL Enerji Ticareti Olanağı | - Ek Kullanım Süresi | -	Paket B Özellikler | Paket B Sistem Kullanım Bedeli | ✅ (anlaşmaya bağlı olarak fiyat değişir) Enerji Ticareti Olanağı | - Ek Kullanım Süresi | ✅	
Tercih			

6. Özellikler	Profil 1	Profil 2	Hiçbiri
Fiyat Farkı	8,5 kr	8,5 kr	Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.
Fiyat Garantisi	6 ay	9 ay	
Enerji Karışımı	%30 Yenilenebilir Enerji & %70 Normal Enerji	%70 Yenilenebilir Enerji & %30 Normal Enerji	
Ödeme Seçenekleri	Paket A Özellikler | Paket A Sistem Kullanım Bedeli | 500 TL Enerji Ticareti Olanağı | - Ek Kullanım Süresi | -	Paket C Özellikler | Paket C Sistem Kullanım Bedeli | - Enerji Ticareti Olanağı | ✅ Ek Kullanım Süresi | -	
Tercih			

<table>
<tr><th>7. Özellikler</th><th>Profil 1</th><th>Profil 2</th><th>Hiçbiri</th></tr>
<tr><td>Fiyat Farkı</td><td>83,2 kr</td><td>101,4 kr</td><td rowspan="4">Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.</td></tr>
<tr><td>Fiyat Garantisi</td><td>6 ay</td><td>9 ay</td></tr>
<tr><td>Enerji Karışımı</td><td>%50 Yenilenebilir Enerji & %50 Normal Enerji</td><td>%30 Yenilenebilir Enerji & %70 Normal Enerji</td></tr>
<tr><td>Ödeme Seçenekleri</td><td>Paket A<table><tr><th>Özellikler</th><th>Paket A</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>500 TL</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>-</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td><td>Paket A<table><tr><th>Özellikler</th><th>Paket A</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>500 TL</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>-</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td></tr>
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<tr><th>8. Özellikler</th><th>Profil 1</th><th>Profil 2</th><th>Hiçbiri</th></tr>
<tr><td>Fiyat Farkı</td><td>83,2 kr</td><td>67,6 kr</td><td rowspan="4">Yenilenebilir enerjiye geçmemeniz durumunda ton başına 60-100 EUR arasında bir karbon vergisi ödeyeceksiniz.</td></tr>
<tr><td>Fiyat Garantisi</td><td>9 ay</td><td>9 ay</td></tr>
<tr><td>Enerji Karışımı</td><td>%70 Yenilenebilir Enerji & %30 Normal Enerji</td><td>%50 Yenilenebilir Enerji & %50 Normal Enerji</td></tr>
<tr><td>Ödeme Seçenekleri</td><td>Paket A<table><tr><th>Özellikler</th><th>Paket A</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>500 TL</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>-</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td><td>Paket C<table><tr><th>Özellikler</th><th>Paket C</th></tr><tr><td>Sistem Kullanım Bedeli</td><td>-</td></tr><tr><td>Enerji Ticareti Olanağı</td><td>✓</td></tr><tr><td>Ek Kullanım Süresi</td><td>-</td></tr></table></td></tr>
<tr><td>Tercih</td><td></td><td></td><td></td></tr>
</table>

Yukarıdaki yenilenebilir enerjiye geçiş için belirlenen özelliklerin profil seçiminize etkisini 1-6 arasında kutucuklarda belirtilen bilgiler doğrultusunda değerlendiriniz.

(1: Hiç Önemli Değil, 2: Önemli Değil, 3: Kararsızım, 4: Önemli, 5: Çok Önemli, 6: Değerlendirmede Göz Önünde Bulundurmadım)

	1	2	3	4	5	6
Fiyat Farkı						
Fiyat Garantisi						
Enerji Karışımı						
Ödeme Seçenekleri						

Devlet Destek Mekanizması Soruları

Bu bölümde, ihracatçı firmaların yenilenebilir enerji tüketimine yönelmesine ve karbon ödemelerini en aza indirmesine yardımcı olmak için hükümetin üstlenebileceği destek mekanizmaları önerilecektir. Ankette beş adet destek mekanizması sunulmuştur.

Bunlar sırasıyla vergi indirimi, ödeme kolaylığı, reklam faaliyetleri, pazarlama aktiviteleri ve veri paylaşımıdır. Her biri yenilenebilir enerjiye geçişi teşvik etmek amacıyla tasarlanırken vergi indiriminde firmaların vergi yükünü azaltmak, ödeme kolaylığında firmaların yeni geçecekleri sistemde oluşacak maliyetleri hafifletmek, reklam faaliyetleri ile firmaların bilinirliğini ve prestijini arttıracak reklam faaliyetleri yürütmek, pazarlama aktivitelerinde yenilenebilir enerjiye geçen firmaların birbirleri arasında iletişimini güçlendirecek ve yeni iş kanalları kurmalarını sağlayacak bir zümre oluşturmak, veri paylaşımında ise devlet tarafından sağlanacak bilgi ve verilerin firmalarla paylaşımı hedeflenmektedir.

Seçimlerinizi yaparken lütfen bu açıklamaları göz önünde bulundurunuz.

Devlet tarafından uygulanacak aşağıdaki destek mekanizmalarından yenilenebilir enerjiye geçiş konusunda şirketinize destek olacağını düşündüğünüzü seçiniz.

(1: Kesinlikle Yararlı, 2-Yararlı, 3: Nötr, 4: Yararsız, 5- Kesinlikle Yararsız)

	1	**2**	**3**	**4**	**5**
Yenilenebilir enerjiye geçen firmalara devlet tarafından uygulanacak vergi indirimi (Yenilenebilir enerjiye geçiş yapan firmalara teşvik sağlamak için normal enerji ile yenilenebilir enerji fiyatları arasındaki fark kadar sağlanacak bir yıllık vergi indirimi)					
Yenilenebilir enerjiye geçen firmalara sağlanacak ödeme kolaylığı (taksitle ödeme imkânı)					
Yenilenebilir enerjiye geçen firmalara özel reklam faaliyetleri (Devlet tarafından desteklenen ve marka görünürlüğünü arttırmak amacıyla düzenlenen reklam faaliyetleri)					
Yenilenebilir enerjiye geçen firmalar için oluşturulacak pazarlama aktiviteleri (Yenilenebilir enerjiye geçen firmalar arasında oluşturulacak özel bir topluluk ve onların düzenlediği prestijli pazarlama etkinlikleri)					
Yenilenebilir enerjiye geçen firmalar arasında sağlanacak veri paylaşımı (Yenilenebilir enerjiye geçen firmalar arasında oluşturulan network ağı sayesinde sağlanacak veri paylaşımı ya da yeni iş anlaşmaları olanağı)					
Yenilenebilir enerji ile normal enerji arasındaki fiyat farkının düşük olması					

Çevre katkı payından kaynak tahsisinde bulunulması					
Devlet desteği					
Diğer (Yukarıdakilerin dışında yararlı olacağını düşündüğünüz bir destek mekanizması varsa lütfen belirtiniz.					

Zaman Tercihi Soruları

Herhangi bir ürünün üretim sürecinde ortaya çıkan tüm CO2 emisyonları için karbon vergisi ödemesi yapılacaktır. Karbon vergisinin devreye girmesiyle Türkiye'deki ihracatçı şirketlerin etkileneceği ve yenilenebilir enerjiye geçiş taleplerinin artacağı öngörülmektedir.

Bu bölümde, iklim değişikliği ve karbon salımında baş rolde olan ve fiyat olarak yenilenebilir enerjiden daha ucuz fosil yakıttan üretilen normal enerjiyi seçerek karbon vergisi yüzünden daha yüksek bir miktar ödeme seçeneğini mi yoksa şu an daha pahalı olan yenilenebilir enerji kullanımı ile sonuçta daha düşük maliyet seçeneğini mi tercih ettiğiniz analiz edilecektir.

Seçimlerinizi yaparken lütfen bu açıklamaları göz önünde bulundurunuz.

Aşağıdaki "Yenilenebilir Enerjiye Geçiş İstekliliği" seçeneklerinden sizin için en uygun olan kutucukları lütfen işaretleyiniz. (0% geçmek istemiyorum, %25 geçmek istiyorum, %50 geçmek istiyorum, %75 geçmek istiyorum, %100 geçmek istiyorum)

Yenilenebilir enerjiye geçilirse ödenecek ekstra elektrik fiyatı (1 ton CO2 başına)	Yenilenebilir enerjiye geçilmezse, üretilen karbon kadar uygulanacak vergi miktarı (ton başına)	**Yenilenebilir Enerjiye Geçiş İstekliliği** (Yenilenebilir enerjiye geçilmezse ödenecek olan vergi miktarı ve ödeme zamanı konusunda belirsizlikler vardır. Seçimlerinizi yaparken lütfen bu durumu göz önünde bulundurunuz.)				
304,94 TL	400 TL olursa	0% (Geçmek istemiyorum)	25%	50%	75%	100% (geçmek istiyorum)
	500 TL olursa	0% (Geçmek istemiyorum)	25%	50%	75%	100% (geçmek istiyorum)
	600 TL olursa	0% (Geçmek istemiyorum)	25%	50%	75%	100% (geçmek istiyorum)
	700 TL olursa	0% (Geçmek istemiyorum)	25%	50%	75%	100% (geçmek istiyorum)

Anket burada sonlanmıştır. Katılımınız için teşekkür ederiz.

T.C.
TOBB EKONOMİ VE TEKNOLOJİ ÜNİVERSİTESİ
İnsan Araştırmaları Değerlendirme Kurulu

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Sayın Prof. Dr. Serdar SAYAN

İnsan Araştırmaları Değerlendirme Kurulu'na etik yönden değerlendirilmek üzere sunmuş olduğunuz 2022-11 kayıt numaralı " Sınırda Karbon Mekanizmasının (CBAM) Türkiye'deki Firmaların Yenilebilir Enerjiye Yönelik Talep ve Davranışları Üzerindeki Etkisi " başlığını taşıyan projeniz etik yönden uygun görülerek onaylanmasına karar verilmiştir.

Bilgilerinizi rica ederiz

Prof. Dr. Tayyibe Nur ÇAĞLAR
Kurul Başkanı

Söğütözü Caddesi No:43 06560 Söğütözü/Ankara
Telefon No:(0312) 292-4000 Faks No:(0312) 287-1946
e-Posta:bilgi@etu.edu.tr İnternet Adresi:www.etu.edu.tr
Kep Adresi:tobbetu@hs01.kep.tr

Bilgi için: Nimet Zorlu
Sekreter