This project is co-funded by the European Union
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TEBD TURKEY-EU BUSINESS DIALOGUE

EUROPEAN GREEN DEAL TRANSFORMATION: A GUIDE FOR TURKISH BUSINESSES AND POLICY DIALOGUE

20 years CFCU REPUBLIC OF TÜRKIYE MINISTRY OF TREASURY AND FINANCE CENTRAL FINANCE & CONTRACTS UNIT

EUROCHAMBRES

CIVIL SOCIETY SECTOR

TOBB

The **Turkey-EU Business Dialogue** (TEBD) is a project co-funded by the European Union under its IPA II programme with Turkey. TEBD is managed by Eurochambres, through a grant contract with CFCU, in close cooperation with TOBB, as the end beneficiary institution of the project. The TEBD activities are implemented through the European and Turkish Chambers of Commerce and Industry, and Commodity Exchanges.

The overall objective of the project is to strengthen mutual knowledge and understanding between Turkish Chambers and Commodity Exchanges, and their counterparts in the EU, thus promoting the integration of EU and Turkish business communities and ensuring a stronger awareness of the opportunities and challenges of a potential future Turkey's accession to the EU in both Turkey and the EU.

The TEBD project wants to promote a constructive private sector dialogue between the EU and Turkey that will lead to positive and lasting results for both sides.

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I. Introduction and Background of The Study

The ongoing degradation of the environment and new environmental threats caused by human activity drive many international, national and local organizations to undertake large-scale initiatives counteracting environmental damages. Due to this, the climate crisis remains the defining challenge of our time. The past five years were the warmest on record. Global average temperature increased by 1.1°C above preindustrial levels by 2019. The impacts of global warming are beyond dispute, with droughts, storms, and other weather extremes on the rise. The recent reports of the IPCC (Intergovernmental Panel on Climate Change) on climate change and 1.5°C global warming, land, ocean and cryosphere underlined the dire impacts if climate change would not be halted.

Around 75% of the EU energy system relies on fossil fuels. Oil dominates the EU energy mix (with a share of 34.8 percent), followed by natural gas (23.8 percent) and coal (13.6 percent). Renewables are growing in share, but their role remains limited (13.9 percent), similarly to nuclear (12.6 percent) according to Eurostat. Not only that, but Europe, like the rest of the world, has its circular economy based on non-renewable products, energy and livelihoods, or at least a large part of it. This presents a dilemma requiring an integrated approach to solving shared problems affecting all communities regardless of location, wealth or level of socio-economic development. There is a global consensus that social and economic development depends on the sustainable management of our planet's natural resources.

Based on the previous information, the European Union wants to change the paradigm in which it currently finds itself, thus the member states lead the global fight against climate change and determined that the EU should take further action now. In order to change that, the Commission sets the European continent on a sustainable path to make this a reality and achieve climate neutrality by 2050. The European Commission presented on December 11, 2019, the European Green Deal (EGD), a package of measures that should enable European businesses and citizens to benefit from a sustainable transition, aiming to achieve climate neutrality by 2050, making Europe the first climate neutral continent, slowing global warming, and mitigating its effects. The European Green Deal aims to boost the efficient use of resources by moving to a clean, circular economy and stop climate change, revert biodiversity loss and cut pollution. It outlines investments needed and financing tools available and explains how to ensure a just and inclusive transition. The EGD in a nutshell is a strategy of the EU aiming to transform the region into a fair and prosperous society with a competitive economy based on energy efficiency and greener attitudes.

The main goals and scope of the European plan are a net carbon neutral European Union by 2050 and a decoupling of economic growth and resource use. The Green Deal is an effort to transform the European general policy strategy, outlining the ambitions and goals in different policy sectors. The agreement covers all sectors of the economy, including transport, energy, agriculture, buildings, and industries such as steel, cement, ICT, textiles, and chemicals. Although carbon neutrality has a target set for 2050, it is extremely important to reduce greenhouse gasses as quickly as possible, so a reduction target of 50 to 55 percent has been set for 2030 in comparison to 1990 emission levels. From that, stepping up to the EU's climate goal of reducing EU emissions by at least 55% by 2030 a set of proposals were made and called Fit for 55, which aims to act in the areas described above and below as a way to decarbonize the economy and reduce environmental impacts.

The European Green Deal is the new growth strategy that aims to transform the EU economy and the society to put it on a more sustainable path. The European Green Deal, approved 2020, is a set of policy initiatives by the European Commission with the overarching aim of making the EU climate neutral in 2050. To attain it, there is a need to rethink policies for clean energy, industry, construction, transport, food and agriculture. The EU is the top destination of Turkish exports and the share of the EU27 market in the total exports of these sectors is 78% for Automotive, 60% for Textiles, 57% for Machinery, 44% for Iron & Steel, and 43% for Chemicals. According to the current studies[1] focused on the effects of the Carbon Border Adjustment Mechanism (CBAM)on Turkish exports to the EU market, the following 10 sectors are expected to be the most affected under these value chains:

- Agriculture & Food
- Plastics & Packaging
- Textile & Garment
- Automotive
- Steel & Iron
- Construction materials: Ceramics

In this respect, TEBD Project identified the sectoral impact framework for these most exposed sectors (with a value chain approach) through the "Digital data collection and analysis" and also prepared "Sectoral White Papers" including Guide for Public Private Dialogue for Green Transformation Roadmaps. 10 SME workshops on these sectors were organized by the 10 Turkish local host Chambers and TEBD team, Eurochambres in collaboration with the Union of Chambers and Commodity Exchanges of Turkey (TOBB), ReDis and; and following our data analysis and SME workshops, with the value chain methodology approach, we compiled this report to reveal the dynamics and structural sustainability indicators of these industries. In this context, first, a description of a general Green Deal impact framework is given for the value chains. Then, an analysis of current trends in these industries in Türkiye are provided to give an overview of sustainability indicators of the value chains. Finally, a presentation of primary recommendations and further projects for green transformation in these industries and value chains are given. In this report combined, is the literature review, data analysis, and the outputs of the SME workshops held in cooperation with TOBB and Chambers of Commerce and Industry from different provinces with the leading companies of these 10 sectors presented in the following sections of the report.

[1] Acar, Asici and Yeldan, 2021, "Potential Effects of the EU's Carbon Border Adjustment Mechanism on the Turkish Economy"

The following local chambers had been actively participated by organising SME workshops and reaching out to companies in the regions.

- Antalya Commodity Exchange - Agriculture
- Aegean Region Chamber of Industry - Food
- Adana Chamber of Industry - Textile
- Bursa Chamber of Commerce and Industry - Automotive
- Iskenderun Chamber of Commerce and Industry - Steel & iron
- Bilecik Chamber of Commerce and Industry - Construction materials
- Istanbul Chamber of Industry - Ready to wear
- Kocaeli Chamber of Industry - Plastics and Packaging

This report is prepared by ReDis Innovation in collaboration with EU Experts, Eurochambres, and TOBB.

ReDis Innovation is a consulting firm and a think tank positioned as an innovation interface in İstanbul and Ankara. ReDis focuses on two main technology areas: Green Technologies and Health Technologies & Life Sciences. Within this scope, ReDis plays two main roles at the innovation ecosystem:

- *ReDis Strategy Lab:*

By regularly analyzing the global agenda and the ecosystem trends in Turkey, ReDis develops data based policy and strategy methodology and roadmaps for different actors of the ecosystem such as government institutions, companies, and startups, and contributes to the policy and strategy ecosystem with the data based methodologies.

- *ReDis Startup Lab:*

ReDis design and implement startup acceleration programs on green technologies and life sciences with different stakeholders. There are six thematic and value-driven startup accelerator programs at the ReDis Startup Lab.

Project Team:

Selin ARSLANHAN- Project Coordinator, Founder of ReDis Innovation

Selin Arslanhan is the founder and director of ReDis Innovation, an innovation interface based in Turkey. She specialized in technology&innovation ecosystem. She carries out projects on innovation and technology to contribute strategy and policy design for both public and private sectors. Previously she was the Innovation Program Director at TEPAV. She established and managed the Innovation Studies Program there. Selin has managed and participated over fifty projects and programs in the areas of technology policy design, strategy development and impact analysis such as "Public-Private Partnership Models in High-Tech Industries", "Startup Accelerator Programs", etc. Selin holds BA in Molecular Biology and Genetics and MBA degree with a thesis on economic valuation of a biotechnology R&D project.

Doç.Dr.Sibel GÜVEN- Senior Consultant, Sustainability and Impact Analysis

Sibel Güven holds a B.Sc. degree in Industrial Management, a M.Sc. degree in Operational Research and a Ph.D. degree in Operational Research from Middle East Technical University. Between 1986 and 1989 she was in Yarmouk University, Department of Business Administration as an Assistant Professor. From 1989 to beginning of 2003 she continued her academic career as an Associate Professor in the Industrial Engineering Department of METU. During her academic career, along with teaching undergraduate and graduate courses, supervising Masters and Ph.D. thesis, conducting research for industry and public sector, and giving continuing education seminars, she worked closely with Turkish industry and public administration bodies, as consultant and/or project manager in national and international projects. After leaving the University in 2003, Güven joined the MNG Group as the Systems Director for Cost Analysis. She has worked at the Economic Policy Research Foundation of Turkey (TEPAV) in the capacity of consultant and expert.She has directed and participated as a team member in various non EU and EU funded projects in the areas of general equilibrium modeling and policy analysis, impact assessment, cluster policy, and energy and environment policies.

Selin ÖZOKÇU- Policy Analyst

Selin Özokcu is an interdisciplinary researcher particularly interested in the transitions in the world, primarily connected to climate change and sustainable development. Following her graduation with a high-honor degree in Business Administration at the Middle East Technical University (METU) in 2012, Özokcu earned her MSc in Earth System Science in the sub-track of Energy, Environmental Economics, and Policy (METU) in 2015. Özokcu also received her PhD in Earth System Science from METU in 2021. In her doctoral dissertation, she examined the consumer culture perspective in the context of the environment, sustainability, and food and specifically addressed the moral judgments of people on food waste practices. Besides, for her graduate studies, she was the recipient of scholarships given under the National Scholarship Program for MSc and PhD Students by The Scientific and Technological Research Council of Turkey (TÜBİTAK).

Cihat BALUKEN- Researcher

Cihat Baluken holds his Master's degree in City Planning and dual Bachelor's degrees in City Planning and Political Science and International Relations. His prior work experience includes involvement in E&S impact management and urbanisation projects. Cihat Baluken is interested in data analytics and environmental impact analysis. He is passionate about supporting NGOs, think tanks, and enterprises in minimizing environmental and social impacts of targeted activities.

Berat YÜCEL- Researcher

Berat Yücel graduated from the Department of Economics at the Middle East Technical University in 2021. Taking part in the Erasmus+ program, he continued his education in the International Economics and Management program at the University of Strasbourg during the fall semester of 2018. He worked as a data analyst in a startup company within METU Technopark between July 2020 and April 2021. He currently continues his education at the Middle East Technical University Economics MSc program. Berat Yücel is interested in data analytics, development economics, international trade, and economic geography.

Geoffrey SALIBA- Malta Business Bureau

Mr. Saliba studied BA Tourism at the University of Malta. He has been working as Campaigns Coordinator at BirdLife in Malta from 2008 to 2011. Later on, he started at Malta Business Bureau in 2011 up to the present, in two different positions. First as Sustainable Development Manager for 2 years, and currently as Business Energy Cluster Manager. Which the main work areas are: Energy Efficiency, Water Efficiency and alternative water sources. Key legislation Energy Efficiency Directive, Water Framework Directive.

António CASIMIRO SOARES CARDOSO– The Portuguese Industrial Association (AIP)

Mr.António CASIMIRO graduated in Environmental Engineering from the Fernando Pessoa University, He has been developing, since 1998, professional activity in the introduction in Portugal, globally, and in the Portuguese Industry, in particular, the use of Natural Gas, for final use, production of thermal and electrical energy . More recently, from 2009, he started to work in areas focused on renewable energy and energy efficiency. Since 2015 he has been developing projects for the development and introduction of Renewable Gases, such as biomethane and hydrogen, as well as CO2 capture and geological storage processes.

The European Green Deal: The Areas of Focus and Scope

1. **In a bigger picture, in order to achieve carbon neutrality by 2050, existing regulations and standards will be revised over the next few years and new laws and directives will be developed and implemented.** There are key areas to achieve the Green Deal plan and change the direction towards decarbonisation of the economy. These areas involve increasing the ambition of climate targets for 2030 and 2050, changing the mindset regarding the way industries operate, the relationship in which the entire productive environment and people act towards the environment in terms of the circular economy, as well as the clear importance of accelerating and mobilising energy and transport to mitigate emissions. That said, the unfolding of these topics and suggestions on how to carry them out are described below:

- Increasing the EU's climate ambition for 2030 and 2050

  The end goal is achieving climate neutrality by 2050 while continuing to grow the economy and create green jobs. Through the 2030 Climate Target Plan, the Commission proposes to reduce EU greenhouse gas emissions to at least 55% below 1990 levels by 2030 – a considerable increase over the previous target of at least 40%.
- Supplying clean, affordable and secure energy
-

  Decarbonizing the energy use at the lowest possible cost , energy efficiency, renewable sources, clean energy, offshore wind production, decarbonization, smart integration, , reducing energy-related methane emissions. household renovation, innovative technologies and infrastructure, such as smart grids, hydrogen networks or carbon capture, energy storage and utilization,

- Mobilizing industry for a clean and circular economy

  The following areas have been covered to date as part of the Fit for 55 package relating to promoting an increasingly clean and circular economy: circular economy, sustainable model of inclusive growth, green and the digital transformation of industry, energy-intensive industries modernization, reducing and reusing materials before recycling them, new business models, prevention against environmentally harmful products, producer responsibility, resource-intensive sectors modernization, reusable or recyclable packaging, biodegradable and bio-based plastics, single use plastics, reusable, durable and repairable products on the market, tackle false green claims, product passport, green public purchasing, sustainable product policy, over-packaging and waste generation, market for secondary raw materials and by-products, cooperation across value chains, separate waste collection, waste shipments and illegal exports, diversifying supply from both primary and secondary sources, climate and resource frontrunners, breakthrough technologies including clean hydrogen, fuel cells and other alternative fuels, energy storage, and carbon capture, storage and utilization, clean steel breakthrough technologies, zero-carbon steel making, collaboration with industry, safe, circular and sustainable battery value chain, growing market of electric vehicles, Digital technologies such as artificial intelligence, 5G, cloud and edge computing and the internet of things, distance monitoring of pollution, transparency on the environmental impact, incentivize people to return unwanted devices.

- Building and renovating in an energy- and resource-efficient way

  Buildings are recognized as using considerable energy, with measures to address this under the Fit for 55 package including: renovation of public and private buildings, construction sector, energy performance of buildings, construction products regulation, circular economy, digitalization, building stock, platform bringing together the buildings and construction sector, architects and engineers and local authorities, innovative financing schemes, renovation of social housing, schools and hospitals.

- A zero-pollution ambition for a toxic-free environment

  Pollution is a key factor affecting quality of life. Tackling pollution is a priority, measures of which include: creating a toxic-free environment, monitor, report, prevent and remedy pollution from the air, water, soil, and consumer products, zero pollution action plan for air, water and soil, natural functions of ground and surface water, biodiversity in lakes, rivers, wetlands and estuaries, limit damage from floods, excess nutrients, urban runoff, micro plastics, chemicals, including pharmaceuticals, combined effects of different pollutants, air quality plans, cleaner air, local communities, air quality standards, pollution from large industrial installations, prevention of industrial accidents, chemicals strategy for sustainability, sustainable alternatives, “one substance – one assessment”, transparency, endocrine disruptors, hazardous chemicals in products.

- Preserving and restoring ecosystems and biodiversity

  Biodiversity loss continues at a globally severe rate, considered a mass extinction event. Halting biodiversity loss and restoring ecosystems is a priority for the EU, measures to achieve this include: biodiversity strategy, protected biodiversity-rich land, protected sea areas, the Natura 2000 network, cross-border cooperation, restore damaged ecosystems, green European cities, increase biodiversity in urban spaces, nature restoration plan, natural capital, common fisheries policy, sensitive areas, well-managed marine protected areas, forest ecosystems, reforestation, afforestation, restoration of degraded forests, increase absorption of CO_2, circular bio-economy, EU forest strategy, effective afforestation, forest fires, bio-economy, forests sustainably, a sustainable “blue economy”, oceans, aquatic and marine resources, nature-based solutions including healthy and resilient seas and oceans, maritime space sustainably management.

- Farm to Fork: a fair, healthy and environmentally friendly food system

  a. Reduce the use and risk of chemical pesticides by 50%.

  b. Reduce nutrient losses by at least 50%.

  c. Reduce the use of fertilizers by at least 20%.

  d. Reduce sales of antibiotics for farm animals by 50%.

  e. 25% of agricultural land is to transition to organic production.

- Accelerating the shift to sustainable and smart mobility

  Transport is another key sector responsible for large GHG emissions. The EU is tackling transport through the promotion of: multimodal transport, efficiency of the transport system, inland freight, rail and inland waterways, combined transport, rail and waterborne transport, short-sea shipping, single European sky, aviation emissions, Automated and connected multimodal mobility, smart traffic management systems, digitalization, sustainable mobility, congestion and pollution, Connected Europe Facility funding instruments, energy taxation, emissions trading to the maritime sector, effective road pricing, sustainable alternative transport fuels, public recharging, refueling points, long-distance travel, less polluting in cities, urban congestion, public transport, CO_2 emission performance standards, emissions of pollutants by airplanes and airport operations.

2. **In summary, all these ambitious goals of the European Green Deal strategy will be achievable through the development of new technologies, sustainable solutions and breakthrough innovations.** This requires intellectual effort and financial support for the research and innovation system, and the acceptance and application by the economic blocks of the new sustainable technologies that will emerge, to drive global awareness in the paradigm that is the preservation of life as we know it.

3. **Fit for 55 is a package of legislative and policy updates aimed at bringing about the EU's green transition in line with the Fit for 55 targets.**. The below targets are for the EU level. Each Member State has its own individual targets, to be implemented according to the country's National Energy and Climate Plans.

Energy Efficiency: EU level 2030 targets

Achievements to date: 29% reduction

Current targets: -32.5% primary energy consumption, -32.5% final energy consumption

Proposed targets: -39% primary energy consumption, -36% final energy consumption

Renewable Energy: EU level 2030 targets

Achievements to date: 22.1% renewable energy

Current targets: 32% renewable energy

Proposed targets: 40% renewable energy

The new directive will also present a sectoral action plan for the below sectors:

Building Sector: by 2030, 49% renewable use

Industrial Sector: a +1.1% increase in renewable energy use annually up to 2030

Renewable hydrogen in industry: 35% of total consumption by 2030, 50% by 2035. It is noteworthy that REPowerEU calls upon the European Parliament and the Council to align the sub-targets for renewable fuels of non-biological origin under the Renewable Energy Directive for industry and transport with the REPowerEU ambition (75% for industry and 5% for transport), and to rapidly conclude the revision of the Hydrogen and Gas Market package.

Heating and Cooling: +0.8% annual increase in renewable energy use up till 2025, +1.1% annual increase in renewable energy use up till 2030

Transport and Fuel: -13% GHG intensity by 2030 OR at least 29% renewable energy use in final consumption share, +5.2% in renewable biofuels of non-biological origin, +1% advanced biofuels by 2025 and +4.4% by 2030

The new rules will additionally present:

- The acceleration of permitting procedures for renewable energy projects
- The further integration of renewable energy in energy grids
- Stricter measures to combat fraud
- Revised criteria for forest biomass aimed at providing enhanced biodiversity protection

II. Sectoral White Papers

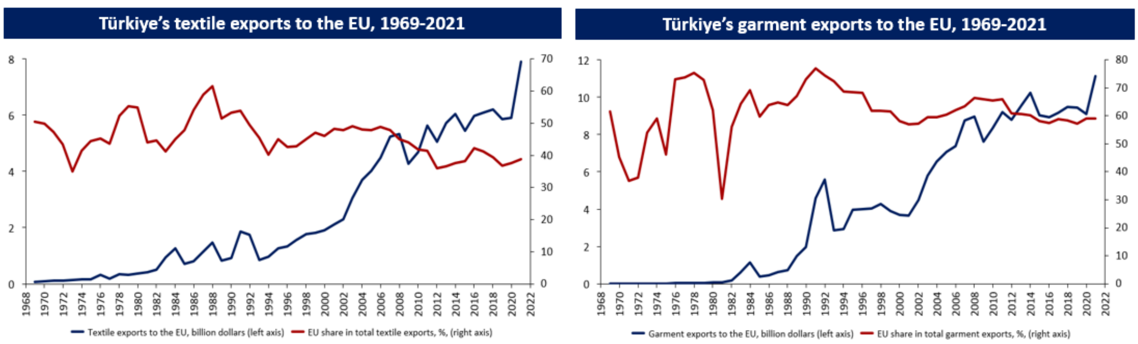
Textile & Garment Value Chain

1. **Textile and garment industries are Türkiye's two prominent locomotive sectors with their high employment, share in GDP, and exports. As these two sectors are also inseparable parts of a value chain, using a value chain methodology, we compiled an integrated report comprising differentiating dynamics and structural indicators of these two industries.** In this context, first, we describe a general EU Green Deal impact framework for the textile and garment value chain. Then, we analyze the textile and garment industries' current trends in Türkiye and give an overview of sustainability indicators of the value chain. Finally, we present primary recommendations and further project ideas for green transformation in the textile and garment value chain. In this report, we present information based on the literature review, data analysis, and the outputs of the workshops held with the leading companies in the textile and garment industries. The workshops were organized with the cooperation of the Adana Chamber of Commerce and Industry, and the Istanbul Chamber of Commerce and Industry, with the participation of more than 100 sector representatives in total. Among the textile representatives, exporting companies operating in Adana and its surroundings, especially exporting to European Union countries, showed great interest. In the Istanbul leg, mostly ready-made clothing companies, which also carry out the design and subsequent processes, contributed.

Textile & Garment Sectors in Türkiye

2. **With a share of 3.7% in total exports in 2021, Türkiye ranks 6th in the world**[2]**, making her one of the biggest textile exporters.** Turkish textiles compete with countries like China and Viet Nam, characterized by their high production volumes with low-cost labor; and countries like Germany and Italy where product quality comes first. Türkiye's trade volume with the EU substantially increased throughout the years. Parallel to that, textile and garment exports have increased each year as seen in figure 1 below. For that reason, Türkiye continues to be a strategic trade partner for the EU in the textiles and garment sectors, along with other sectors.

Figure 1. Türkiye's Textile and Garment Exports to the EU, 1969-2021.



Source: TURKSTAT, TEPAV calculations

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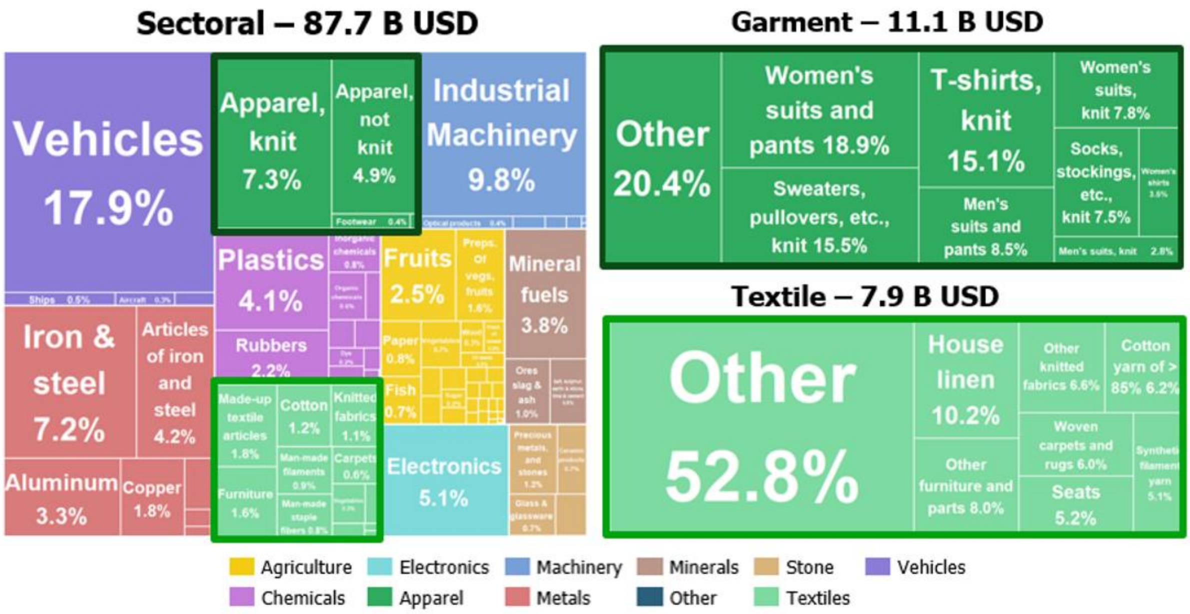
[2] Ministry of Trade, (2022), "Apparel Sector Report", https://ticaret.gov.tr/data/5b87000813b8761450e18d7b/Haz%C4%B1r%20Giyim%20Sekt%C3%B6r%C3%BC_2018.pdf

3. Based on our analysis, it was decided to focus on the sub-sectors that had the highest export figures to EU countries. The distribution of Turkey's garment and textile exports to the EU is exhibited in Figure 2. In this context, the focus was on the export of cotton and cotton products, which had one of the highest exports to the EU with 13.3% following garments with 20.3% and furnishings with 17.5%. Therefore, the value chain and sustainability analyses were carried out for both garments and cotton. Accordingly, the companies that were invited and participated in the workshops were the cotton and garments representatives.

Figure 2. Distribution of Turkey's Exports to the EU By Sectors and Products, 2021

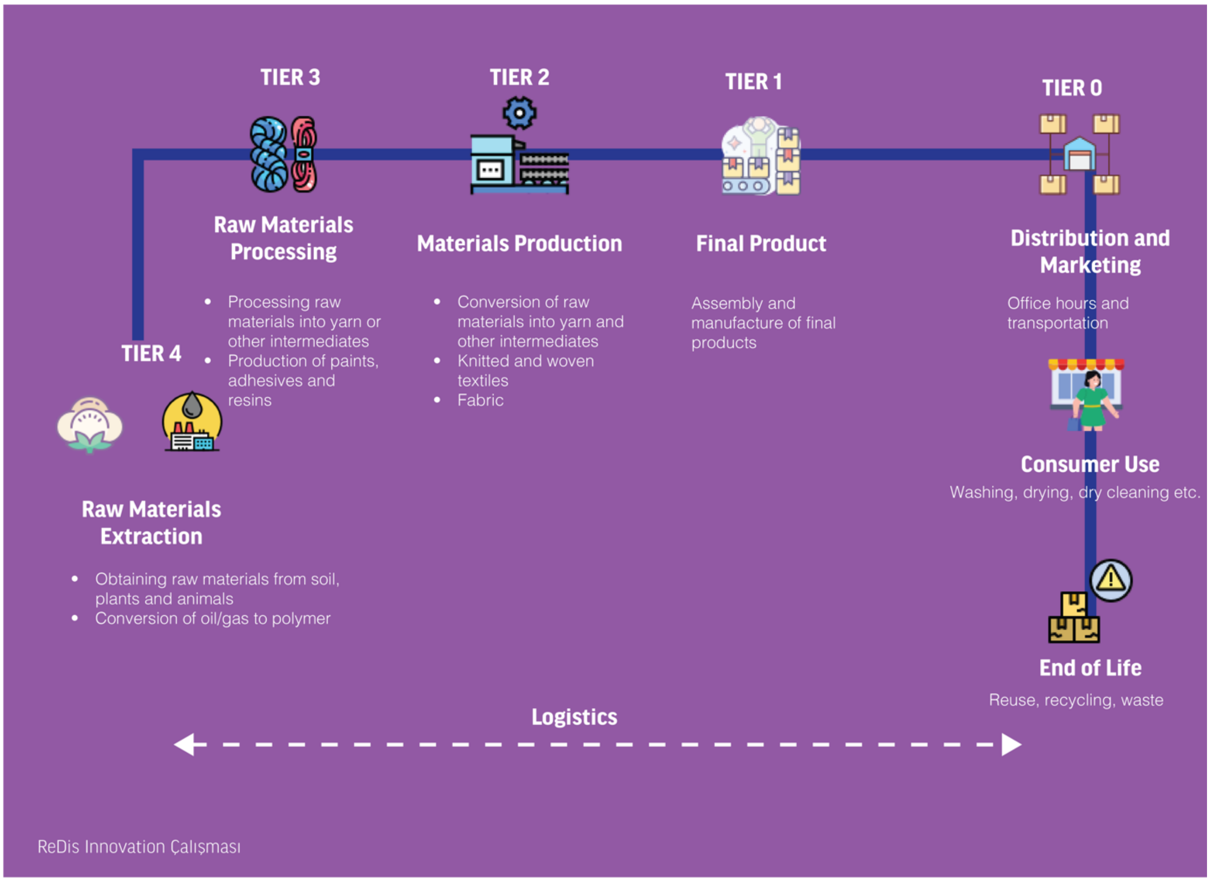


Source: TURKSTAT, TEPAV calculations

General Overview of Textile and Garment Industries Value Chain and Sustainability Indicators

4. **The first stage in the value chain, which appears to be similar in the life cycle of both the textile and garment industries, is the raw material extraction stage.** Since cotton has the highest export figures as a raw material in the textile sector, the value chain of the cotton industry has been discussed and analysis has been made accordingly. As synthetic fibers are heavily used in the garment sector, synthetic fibers produced from polymers are also added to the value chain. After this point, the raw materials produced begin to be processed and are subjected to washing, stretching, rolling and washing, and dyeing processes. This is the stage where, among others, the highest carbon emissions are seen. This stage includes common stages for both cotton textile products and synthetic apparel. The areas with the highest carbon emissions may be related to the nature of the energy used. It can be very important that the energy used does not come from sources using coal and is obtained from renewable energy. All these stages in the value of textile and garment industries are shown in Figure 3 below.

Figure 3. Textile & Garment Industries Value Chain

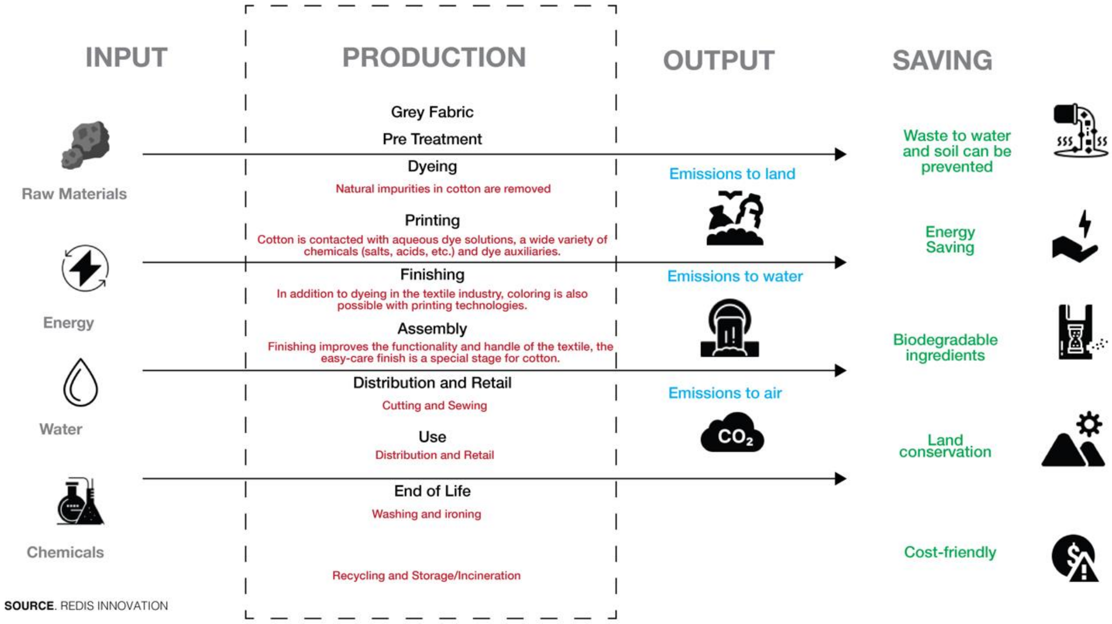


Source: JRC BAT Report, 2003[3] and ReDis Innovation, 2022.

5. **We then carry out a sustainability input and output analysis of the textile industry** (as described in Figure 4)**.** It is known that the cultivation of cotton is a stage that requires intense water usage. Several chemicals are also used. As there is not much energy consumption in this first stage, where it is mostly fuel for transferring cotton to the factory, it can be said that it is labor-intensive. In the SME workshop, a significant number of textile industry representatives mentioned that costs and losses can be reduced, especially by using clean and high-quality cotton, related to the use of raw material inputs. This issue addresses the process of pre-treatment at the ginning factories. Whereas there is intensive use of technology, energy and chemicals in the dyeing and printing stages. Therefore, the carbon emissions from electricity, obtained from coal, may be very high. The water and chemicals used in the dyeing phase mix with each other and if they are released into the environment without serious water treatment, the pollutants to the water and land sources will be high. The amount of total water and energy used is also expected to affect the emission rates released to the environment.

[3] Schönberger, H., and Schäfer, T., (2003), "Best Available Techniques in Textile Industry", Federal Environmental Agency (Umweltbundesamt), Berlin.

Figure 4. Sustainability Input and Output Analysis of the Textile Value Chain



Source: WRI (2021)[4] and Aii (2021) [5], Moazzem et al. (2021)[6], and ReDis Innovation (2022).

6. **In the SME workshop, the carbon emissions released in the dyeing and finishing phases were particularly emphasized, together with high energy consumption in all phases.** It has been stated by many sector representatives that energy use constitutes 80% of their total costs. They expressed that due to high energy use, there is a substantial increase in carbon emissions. However, most companies stated that they use electricity supplied by the national grid and do not actually know its source. In addition, some sector representatives stated that the amount of electricity to be obtained from renewable energy cannot fully meet the total energy demand in the sector. They specifically expressed their concerns regarding the inability of renewable energy to provide energy, especially at night, as the factories operate on a 24-hour basis. On the other hand, many participants stated that they do not have carbon and sustainability data for the chemicals they use. New developments in the industry target innovation and sustainability solutions, particularly for dyeing and finishing tiers. By implementing innovative solutions, there may be possible savings such as avoiding pollution to water and land, energy saving, biodegradable outputs instead of chemicals, and cost savings. Regarding the packaging, distribution, and office work stages, emissions are generated during the daily commuting of personnel and distribution of the final products, which are emissions to the air through transportation.

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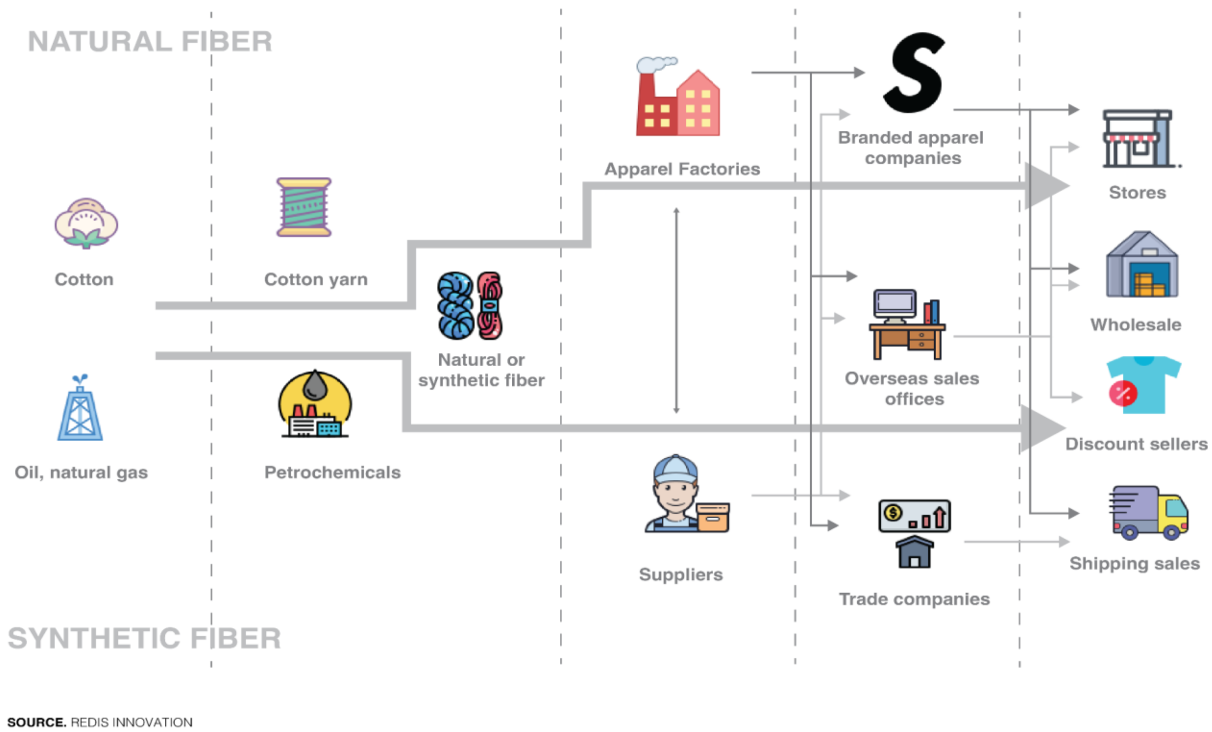
[4] Sadowski, M., Perkins, L. and McGarvey, E., (2021). "Roadmap to Net-Zero: Delivering Science-Based Targets in the Apparel Sector." Working Paper. Washington, DC: World Resources Institute. Available online at https://doi.org/10.46830/wriwp.20.00004

[5] Apparel Impact Institute, (2020), Annual Impact Report.

[6] Moazzem, S., Crossin, E., Daver, F., and Wang, L., (2021). Environmental impact of apparel supply chain and textile products. *Environment, Development and Sustainability*, 1-19, https://doi.org/10.1007/s10668-021-01873-4

7. **The process flow and related networks of the garment industry are depicted in Figure 5.** For raw materials production, there are two main actors: petrochemical firms for synthetic materials and farmers for cotton production. The raw materials are then converted into synthetic fibers or cotton yarns and fabrics. These materials are then transferred to apparel manufacturing, which is the first stage of a processed fashion product. The actors in this stage are only manufacturers and suppliers. The process gets more complicated in the later stages as the brands, offices, and trade firms are involved. The final finished products meet with the customer at the retail stores, wholesale chains, discount stores, and factory sale points.

Figure 5. Process Flow and Networks Around Garment Industry

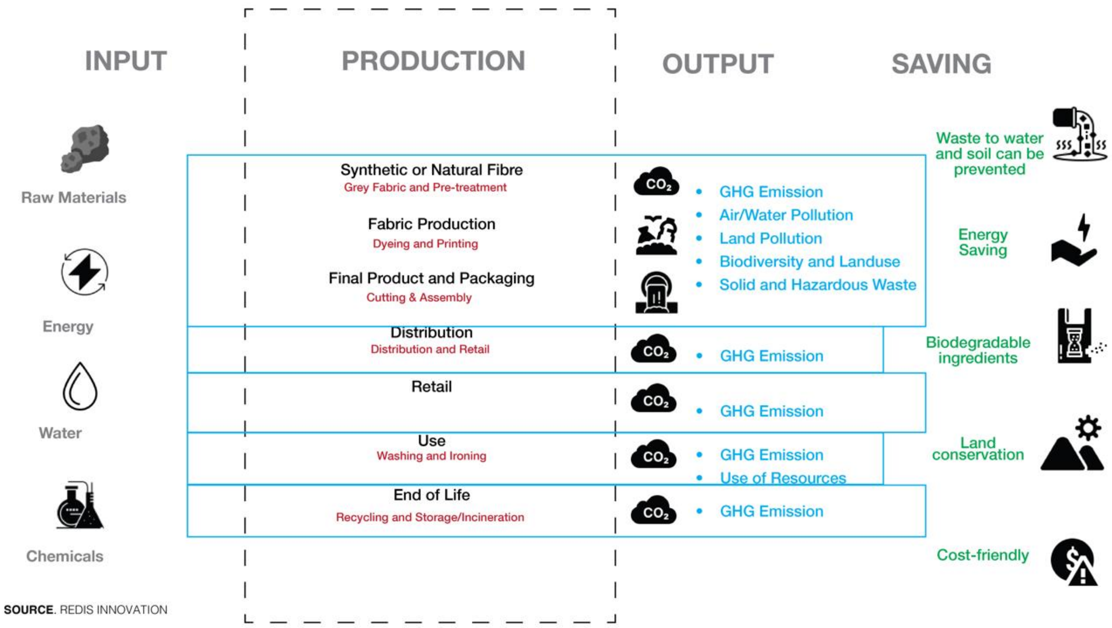


Source: UNIDO, 2022.[7], ReDis Innovation Visualization (2022).

[7] UNIDO, (YEAR), "The Global Apparel Value Chain: What Prospects for Upgrading by Developing Countries", and ReDis Innovation Visualization, 2022.

8. **The sustainability input and output analysis of the garment industry are described in Figure 6.** The main inputs are raw materials, energy, water, and chemicals which result in emissions to the land, air, and water as outputs, at the end of the production and distribution processes. From the sustainability perspective, there are a couple of processes that need to be investigated regarding the use of raw materials, water, and energy. The first is energy, mostly used as electricity at the production tiers. The source of electricity production matters since carbon emissions drastically increase when coal or fossil fuels are used in the production of electricity. During the discussions with the manufacturers at the workshop, many of them described when and where they used electricity and where they acquired the required energy. In most cases, electricity is provided by the national grid system which makes it difficult, and almost impossible to determine the source of the power as the government does not disclose to the users the mix of the sources used in the production of electricity provided through the national grid. Additionally, some manufacturers declared that they have started to produce electricity themselves from renewable sources such as wind and solar energy. The second issue regarding the emissions as outputs from the production process is the use of freshwater , and releasing polluted water to nature after usage, without recovery. Textile and apparel production requires much water use at the beginning, for farming activities, and during the dyeing stages. Thus, extensive use of chemicals at both stages pollutes the water with non-degradable products and causes a degradation in land and water quality.

Figure 6. Sustainability Input and Output Analysis of the Garment Value Chain



Source: WRI (2021)[8], Aii (2021)[9], Moazzem et al. (2021)[10] and ReDis Innovation (2022).

[8] İbid, 2021.
[9] İbid, 2021.
[10] İbid, 2021.

Green Transformation in the Textile and Garment Industries

9. **In developing countries, the textile sector has the highest footprint in terms of environmental, social, and health effects, mostly occurring in raw material production and manufacturing parts of the whole textile value chain.**[11] For instance, one study reports that raw material production generates 61% of carbon emissions throughout the entire value chain.[12] World Resource Institute[13] lists six interventions for the textile and apparel sector to reduce emissions:

    a. Maximizing material efficiency: The purpose is decreasing the amount of fiber and materials which are wasted in each part of the production process, through design, material selection, and manufacturing methods.

    b. Scaling sustainable materials and practices: The purpose is promoting the use of more sustainable materials (such as recycled polyester) and practices (such as conservation tillage for cotton).

    c. Accelerating the development of innovative materials: The purpose is increasing investment in next generation materials through textile recycling, the use of bio-based materials, and plant-based leather.

    d. Maximizing energy efficiency: The purpose is increasing energy efficiency across manufacturing facilities.

    e. Eliminating coal in manufacturing: The purpose is replacing coal in the production process as coal is the most polluting fossil fuel.

    f. Shifting to 100 percent renewable electricity: The purpose is increasing the capacity of renewable electricity to its maximum level across the supply chain.

10. **According to the BAT report prepared by the European IPPC Bureau and published in the textile and garment industry, carbon reductions can be achieved with some optimizations and changes in the process.** One of the methods is to use the resulting heat in other stages or to convert it into electrical energy together with steam power and use it within the facility itself. In addition, technological advances to be made in the machinery to be used are seen as very good developments as they will encourage the use of less energy, water, and chemicals. Finally, it was emphasized that the chemicals used in the BAT report should be produced from high quality, biodegradable, or biomaterials. With these developments, carbon emissions will be reduced for both sectors at the production stage.

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[11] UNECE, (2020), "Accelerating action for a sustainable and circular garment and footwear industry: which role for transparency and traceability of value chains?", https://unece.org/DAM/trade/Publications/ECE_TRADE_449-AcceleratingTanspRraceabilityTextile.pdf

[12] Munasinghe, M., Jayasinghe, P., Ralapanawe, V., & Gajanayake, A., (2016), "Supply/value chain analysis of carbon and energy footprint of garment manufacturing in Sri Lanka", *Sustainable Production and Consumption*, *5*, 51-64.

[13] Sadowski et al., (2021), ibid.

11. **To decarbonize the value chain in the textile & garment industries, there are some solutions that need to be implemented in different stages**. Maximizing the efficiency of the material is a proven solution that is readily available in all tiers from the beginning. For the first tiers, it is crucial to provide sustainable material preference by using products such as organic cotton or new generation materials to minimize emissions in the later stages. Efficiency in energy saving and converting the energy sources to %100 percent renewable energy is a long-term investment for the companies not only bringing down the emissions but also minimizing energy costs by amortizing the investment in 5 to 6 years. Surely the use of coal as an energy source should be avoided and eliminated.

Figure 7. Sustainability Strategies for Textile and Garment Industries

Source: Islam and Rana (2012)[14], Ellen Mac Arthur Foundation (2017)[15], McKinsey (2022)[16], Munasinghe et al. (2016)[17], and ReDis Innovation (2022).

[14] Islam, T. & Rana, M., (2012). Upgradation of Bangladeshi Apparel firms in the Global Value Chain: Knowledge Spillover and Dynamic Capability Perspective.

[15] Ellen MacArthur Foundation, (2017), “A new textiles economy: Redesigning fashion’s future”, http://www.ellenmacarthurfoundation.org/publications

[16] McKinsey & Company, (2022), “The State of Fashion”.

[17] Munasinghe et al. (2016), ibid.

12. **For the garment industry, the first thing manufacturers need to figure out is using continuous machinery technology that would make less use of water and electricity.** The second strategy is about combining three processes, dyeing, washing, and final treatments. The combination would make an effect by minimizing process time and energy costs. The third corresponds to a more innovative solar energy solution by heating the wastewater by solar panels and using steam for energy production. Next, making installations would make a difference in the heat energy loss at each step of the process. The most important parts of reuse functions are the water and the product loss. On the one hand, water can be reused to reduce the carbon load by water recovery facilities. On the other hand, manufacturers should realize the production loss or fashion waste as a potential raw material. The waste products create an enormous environmental impact, and a closed loop recycling system would benefit any organization by reducing costs and carbon emissions. All these strategies to make textile and garment industries more sustainable are summarized in Figure 7 above.

13. **The European consumption of textiles has the fourth highest impact on the environment and climate change, after food, housing and mobility. It is the third sector for higher use of water and land use, and fifth for the use of primary raw materials and greenhouse gas emissions.** Looking forward for the transformation of EU economy, the Green Deal proposes measures under two Textiles related policies: the EU Strategy for Sustainable and Circular Textiles and the **Transition Pathway for the Textiles Ecosystem**. Proposed measures include:

    - New design requirements for textiles setting mandatory minimums for the inclusion of recycled fibers in textiles, making them longer lasting, and easier to repair and recycle.
    - Clearer information on textiles and a Digital Product Passport based on mandatory information requirements on circularity and other key environmental aspects.
    - Tight controls on greenwashing
    - Action to address the unintentional release of microplastics from textiles.
    - Harmonized EU rules on extended producer responsibility for textiles, and economic incentives to make products more sustainable ("eco-modulation of fees")
    - Support to research, innovation and investments and to the development of the skills needed for the green and digital transitions.
    - Addressing the challenges related to halting the export of textile waste.

Construction Materials: Ceramic Industry

1. **The construction environment is commonly recognized as a major contributor to global environmental impacts.** Up to 50% of all raw materials extracted from the lithosphere are consumed by this sector, responsible for roughly 40% of global greenhouse emissions. In the European Union, buildings and construction are responsible for a large part of the total energy consumption (about 40%) and of greenhouse emissions (36%), along the entire chain from construction to demolition, passing through utilization and maintenance. The construction sector is responsible for over 35% of the EU's total waste generation. Approximately 1 billion tons of waste, which is around one-third of the total amount generated in EU 27 each year, comes from Construction and Demolition (C and D) activities. The need for more sustainable and improved use of natural resources in this sector has been recognized at the EU level by the Raw Material Initiative. This is reflected in the challenging target that has been set to increase the recovery and recycling of Construction and Demolition Waste (CDW) across Europe.

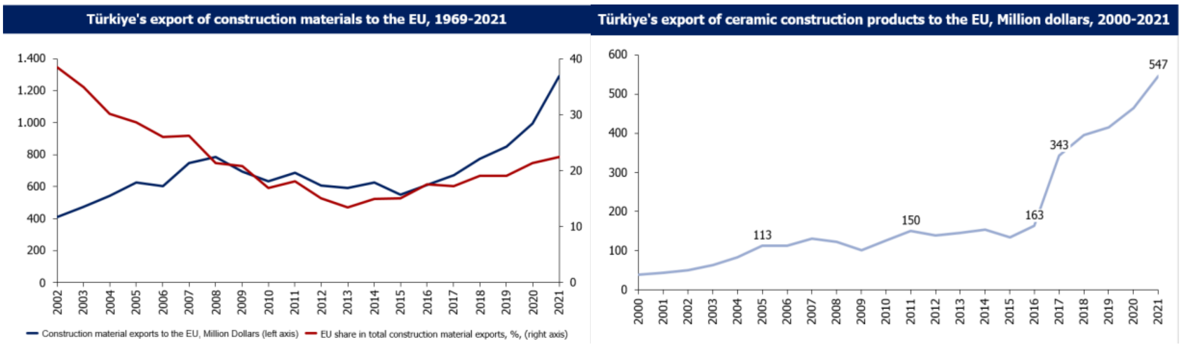
2. **While the share of the EU in Türkiye's construction materials export is over 20%, about half of these exported construction materials are ceramic based materials. In the meantime, ceramics export plays a critical role in the total construction material export of Türkiye to the EU.** With a value chain methodology approach, we compiled this report to reveal the dynamics and structural indicators of the ceramic industry. In this context, first, we describe a general Green Deal impact framework for the ceramic industry value chain. Then, we analyze current trends in the ceramic industry in Türkiye and give an overview of sustainability indicators of the value chain. Finally, we present primary recommendations and further projects for green transformation in the ceramic value chain. In this report, we combine the literature review, data analysis, and the outputs of the workshop held with the leading companies of the ceramic industry in cooperation with the Bilecik Chamber of Commerce and Industry.

Ceramic Industry in Türkiye

3. **As ceramic production requires clay as the main raw material, specific types of earth groups are utilized in ceramic production.** For this reason, ceramic factories have to be established in places where the soil is suitable. This contributes to reducing emissions and costs arising from the transportation of raw materials. On the other hand, since the sector is labor-intensive these ceramic production facilities need to be located in urban areas. Consequently, choosing a location for ceramic factories tends to be rather strategic. Ceramic production has been intensified in regions where appropriate soil exists, not far from urban settlements in Türkiye as well. Bilecik, specifically Bozüyük, Kütahya, İzmir, and Çanakkale are the cities and regions in Türkiye where the ceramic facilities cluster. Bilecik Chamber of Industry and Commerce hosted the meeting as many of the biggest tile producers are located in Bozüyük, a district of Bilecik. More than a dozen companies from the Bozüyük district participated in the workshop.

4. **Türkiye exports nearly 1.3 billion USD of construction materials to the EU by 2021 with a 135% percent growth between 2015 and 2021.** With this remarkable growth rate, the EU's share in Turkey's total exports of construction products reached 22.4% by 2021 as seen in Figure 8 below. Similarly, ceramic construction product export to the EU has increased by approximately 3.5 times to 547 million dollars between the period of 2015-2021, akin the ceramic construction industry one of the best-performing sectors in this five-year period.

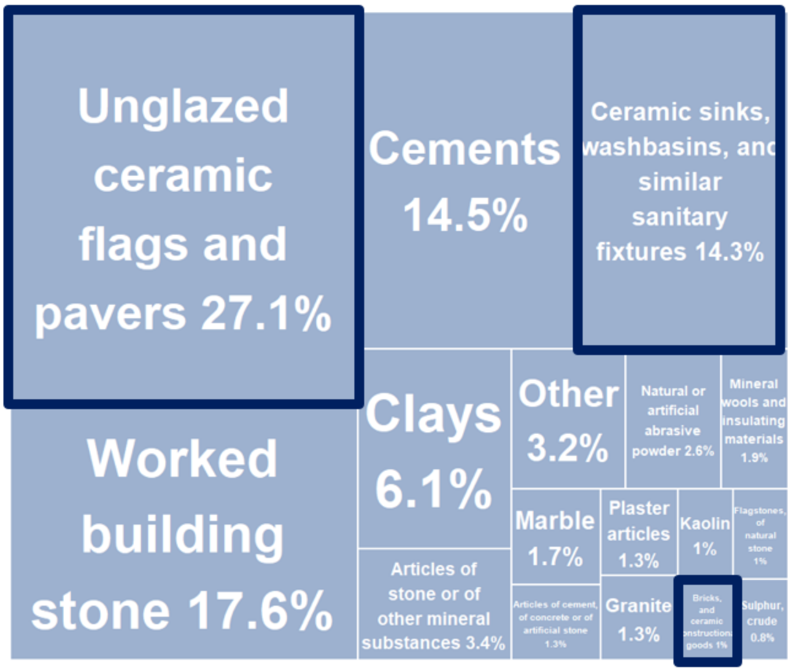
Figure 8. Türkiye's Construction and Ceramic Construction Export to the EU



Source: TURKSTAT, TEPAV Calculations

5. **Ceramic construction materials export to the EU accounts for 42.4 of total construction materials export to the EU making ceramics the group with the highest export share in construction materials.** Türkiye's export of unglazed ceramic flags and pavers; ceramic sinks, washbasins, and similar sanitary fixtures; and bricks and ceramic construction goods to EU are 349.4, 184.8, and 12.4 million dollars respectively. Their shares in Türkiye's export of construction materials to the EU are revealed in Figure 9.

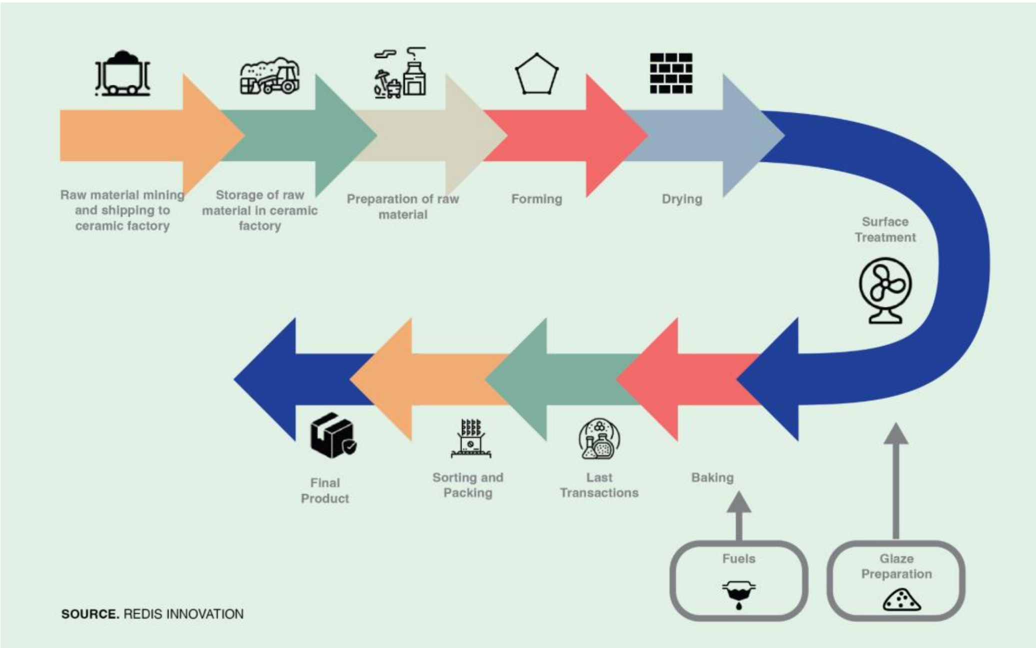
Figure 9. The Distribution of Türkiye's Export of Construction Materials to the EU, 2021



Source: TURKSTAT, Author's Calculations and Visualizations

6. **Figure 10 illustrates the first stage of the value chain of ceramic products, which is the extraction of soil and transferring it to the site, and the preparation of the raw material following the extraction phase.** At the preparation stage, various chemicals, sand, such as gravel, and clay are mixed, and specific formulas for different ceramic types are applied. In The inputs and outputs used in ceramics production are listed in Figure 11. Accordingly, clay, mud, slime, kaolin , rock, broken products, ore, liquid sulfite, and water are the substances used in the first stage of the ceramics formula. It should be noted that in the workshop, sector representatives, and some experts emphasized how hard it is to obtain good quality raw materials due to geopolitical difficulties. They have underlined that especially with the break in the global value chains due to the Russian invasion of Ukraine, the desired quality of soil imported from Ukraine has been disrupted.

Figure 10. Ceramic Industry Value Chain

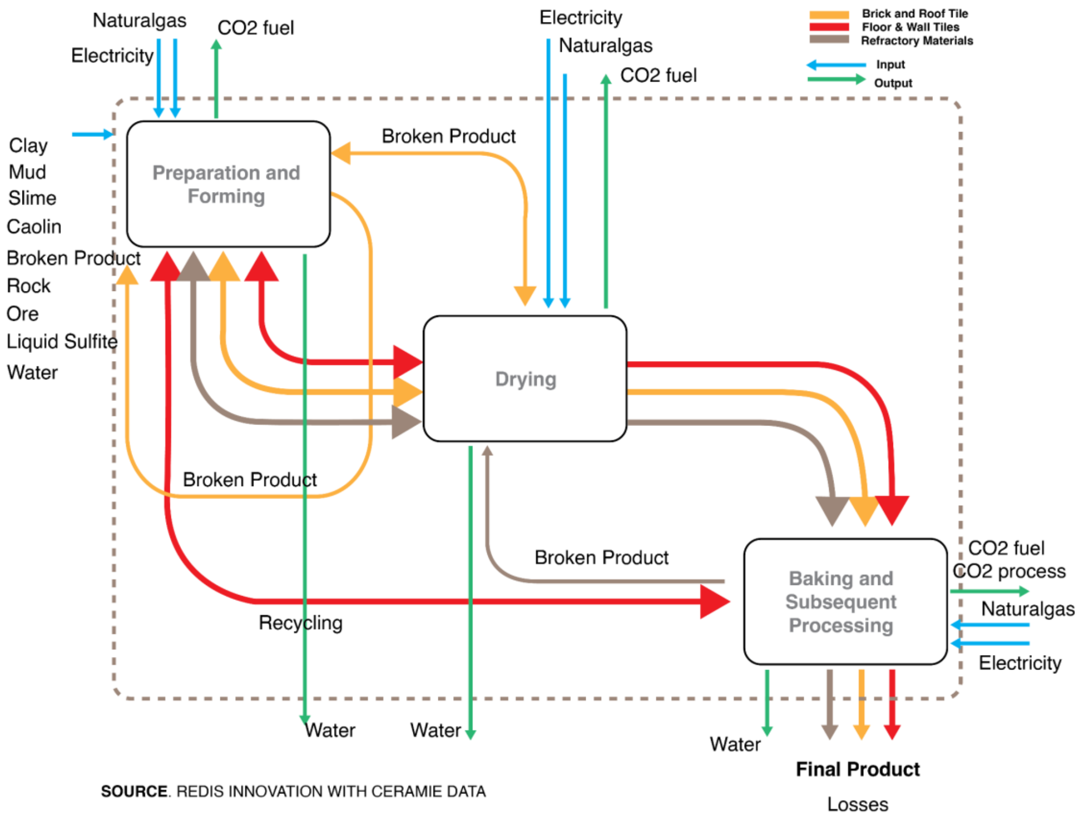


Source: Cerame Unie (2021)[18] and ReDis Innovation Visualization (2022).

[18] ibid, 2021.

7. **Ceramics are formed with specific formulas and moved to the drying stage as shown in Figure 11, in the drying phase electricity and natural gas are used as the basic inputs.** The discharged water is the critical output at this stage, and in the SME workshop, the project team directed a question regarding how they dealt with wastewater. Apparently, companies located in an organized industrial zone (OIZ) can have the opportunity to use OIZ's wastewater treatment facilities, if it has any. Participants also explained that water treatment varies among manufacturers regarding their location, level of technology, and recycling. While some producers stated that they recycle water by establishing treatment plants themselves, some producers mentioned that they released the water to rivers after treating it. A sector representative mentioned that as the recovery of wastewater increases, it can even reach the level of zero water consumption.

Figure 11. Sustainability input and output analysis of the ceramic industry value chain

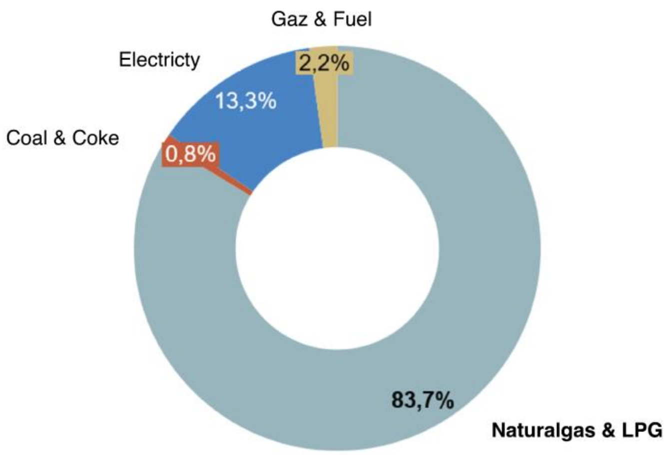


Source: Ceramie Unie (2021)[19], ReDis Innovation (2022).

[19] ibid, 2021.

8. **The production of ceramics is an energy-intensive process. As exhibited in Figure12, natural gas and LPG have the highest share by far with more than 80% of the energy resources used in the ceramics industry.** After the increase in natural gas prices, companies turned to sources like hydrogen, but it is not yet an established system as one of the company's representatives stated. Clearly, even though natural gas is vital for the ceramics industry, manufacturers are seeking a way of reducing costs by renewable energy or hydrogen. However, there are still some barriers to using renewable energy as much as required. One of the representatives of the company stated that they are having trouble increasing the size of their solar energy plant within the site due to energy production permits, and restrictions on total capacity. On the other hand, some companies mentioned heat recovery and stated that it is used by many manufacturers. According to an industry representative, recovering heat through a heat regulator provides approximately 10% savings.

Figure 12. Different Sources of Energy in the Ceramics Industry

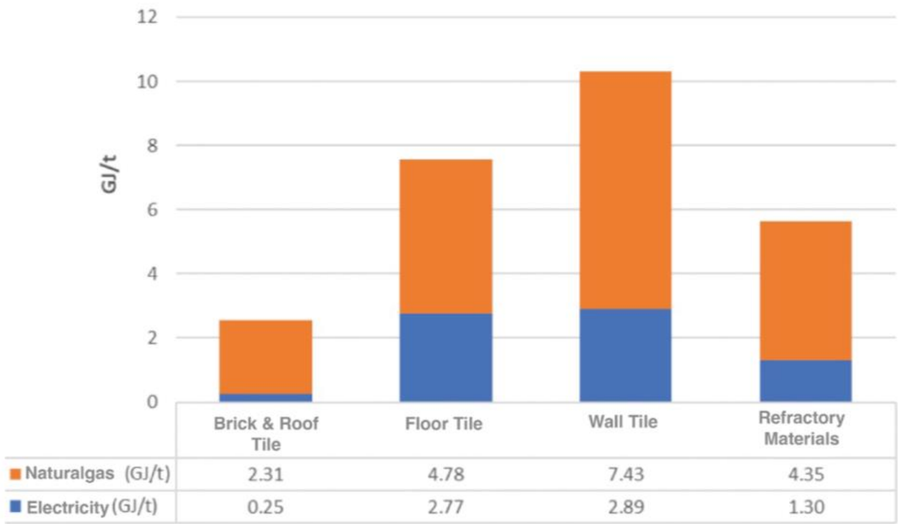


Source: UK Department for Business, Energy & Industrial Strategy (2021)[20]

9. **Figure 13 demonstrates the types of energy used in the production of different ceramic products.** While brick and roofing materials require rather less energy, the production of wall tiles needs the highest amount of energy. Although energy use in the production of floor tiles and refectory materials is similar, the distribution between natural gas and electricity use is different. This graph, along with underlining the varying amounts of energy use among different ceramic products demonstrates the significant use of natural gas in ceramics production**.**

[20]U.K. Department for Business, Energy & Industrial Strategy, Industrial Decarbonisation & Energy Efficiency Roadmaps to 2050

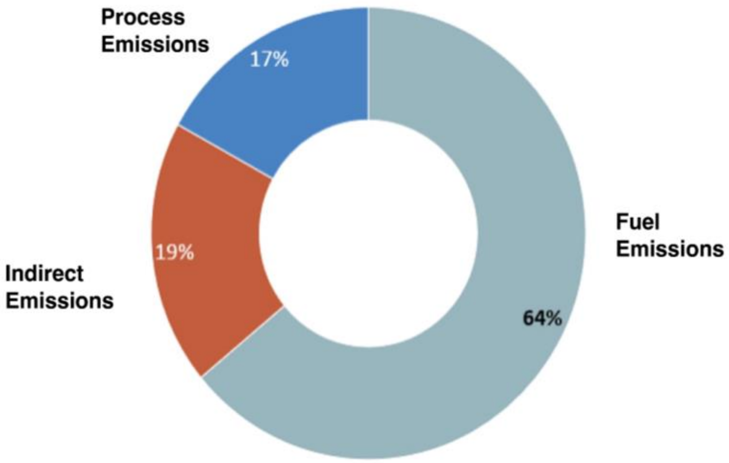
Figure 13. Energy Use per Product



Source: Besier & Marsidi (2020), p. 18[21]

10. **In the ceramic industry, the majority of emissions stem from combusting fossil fuels.** As revealed in Figure 14, combusting fossil fuels accounts for the largest share of emissions in the ceramic industry according to fuel types. Fossil fuel emissions are followed by indirect emissions covering transportation, purchased goods and services, and process emissions, respectively. The figure underscores the importance of fossil fuels in the ceramic industry. The lack of energy diversity in the sector not only puts producers in a difficult situation in the face of increasing costs but triggers high carbon emissions also. In order to find solutions to the challenges of the energy supply, a just transition to innovative and renewable energy sources should be prioritized.

Figure 14. Distribution Of Fuel Types Used in The Ceramic Industry, %



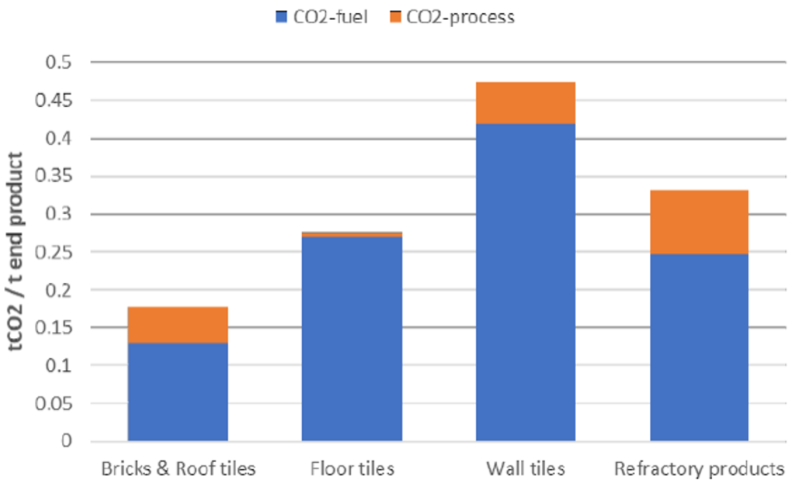
Source: The European Ceramic Industry Association, 2021 (2020), p. 18[22]

[21]Besier & Marsidi. (2020). Decarbonisation Options for the Dutch Ceramic Industry

[22] The European Ceramic Industry Association, 2021

11. **Figure 15 depicts the calculated average emissions per ton of an end product, which is elaborated in this report.** According to the chart, the production of wall tiles has the highest carbon emission levels. The wall tile is followed by refractory materials, floor tiles, and bricks & roof tiles respectively. Emissions can be reduced with innovative approaches that can be employed in the design of these materials. In the workshop, sector representatives explained some of the measures taken up till now. First, companies pointed out that they started carbon emission measurements in line with the guidelines of the Ministry of Environment, Urbanization, and Climate Change. One representative mentioned that carbon certificates are now asked for orders coming from Scandinavia and this practice has now spread across Europe. Second, they have intensified their research and development efforts regarding design within the companies. One company emphasized that they applied innovative design, for instance for wall tiles by reducing the thinness which gives very good results in terms of reducing costs and emissions.

Figure 15. Carbon Emissions per Ceramic Products



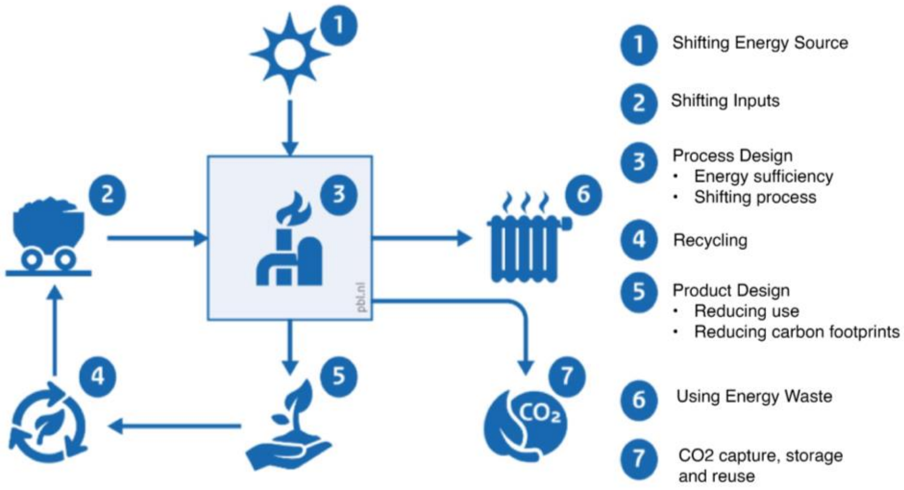
Source: Besier & Marsidi (2020), p. 21[23]

Green Transformation in the Ceramic Industry

12. **In the ceramic sector, various strategies and solutions are currently utilized to reduce emissions at every stage of the value chain.** Figure 16 presents current innovative solutions in different phases of the ceramic value chain. As shown in the figure, the conversion of energy sources to greener and renewable energy sources is among the top priority solutions. This is not very surprising concerning the importance of fossil fuel emissions proportion in the sector.

[23] Besier & Marsidi (2020), ibid.

Figure 16. Sustainability Solutions for the Ceramic Industry



Source: Besier & Marsidi 2020[24]

13. **The project team asked further questions to the company representatives regarding the diversification of energy resources and green transformation to understand how companies employ strategies to reduce the dependency on fossil fuels.** Some company representatives mentioned that they have started to install solar energy panels on the factory site. However, the amount of energy obtained from these solar panels is far from the total amount of consumed energy. Thus, they stated their intentions for energy transformation and further stressed that although regulations make this transformation difficult, they are ready to undertake the monetary burden of financing the transformation. In addition, companies declared that they believe state support and incentives would facilitate the transition to green energy, as well as preparing a clear national roadmap.

14. **Moreover, the inputs should be regulated to decrease carbon emissions.** Since transportation contributes to higher emissions for exported products, using locally produced inputs may be more appropriate and efficient in terms of carbon footprint. Although process design and efficiency have the third place for sustainability solutions, product design may be even more crucial than anticipated as mentioned by participants in the workshop. Industry representatives stated that thinner, lighter, and more durable production decreases emissions. In the literature, product design is also referred to as a way of reducing carbon emissions by designing a lighter and more durable ceramic product. During the workshop participants reported that they calculate greenhouse gas (GHG) emissions according to the regulations of Monitoring, Reporting, and Verification, enacted by the Ministry of Environment, Urbanization, and Climate Change. However only Scope 1 emissions are disclosed according to the regulation. As Scope 2 and Scope 3 emissions are relatively high, companies have already started to work on calculating these emissions and reducing them.

[24] Besier & Marsidi (2020), ibid.

15. **In order to increase material efficiency and reduce climate impact, the EU is launching a comprehensive new strategy for a sustainable built environment.** This strategy will ensure coherence across relevant policy areas such as climate, energy and resource efficiency, management of construction and demolition waste, accessibility, digitalization and skills. It will promote circularity principles throughout the lifecycle of buildings by:
    - addressing construction products' sustainability in line with the Construction Product Regulations.
    - promoting the durability and adaptability of built assets in line with the circular economy principles for buildings design
    - developing digital logbooks for buildings
    - using level(s) to integrate life cycle assessment in public procurement and the EU sustainable finance framework as well as to explore potential carbon reduction targets and carbon storage
    - considering a revision of material recovery targets set in EU legislation for construction and demolition waste
    - promoting initiatives to reduce soil sealing, rehabilitate abandoned or contaminated brownfields and increase the safe, sustainable and circular use of excavated soils

    Furthermore, the Green Deal's ‘renovation wave’ initiative can lead to significant improvements in energy efficiency in the EU, implementing the initiative in line with circular economy principles, notably optimized lifecycle performance, and longer life expectancy of built assets.

Iron & Steel Value Chain

1. **Türkiye is among the top 10 countries in iron and steel production and it also ranks second among the countries exporting to the EU**.[25] The iron & steel industry is an emission intense industry as it employs 8% of the total energy consumption around the world.[26] Considering the total emission values of the sector and the size of the exports from Türkiye to the EU, the iron & steel sector occupies an important place within the framework of the European Green Deal. These two sectors are also inseparable parts of a value chain, so we compiled an integrated report explaining differentiating dynamics and structural indicators of these two industries with a value chain methodology**.** In this context, we describe a general Green Deal impact framework for the iron and steel value chain. We analyze the iron & steel industries' current trends in Türkiye and give an overview of sustainability indicators of the value chain. Finally, we describe primary recommendations and further projects for green transformation in the iron and steel value chain. In this report, we combine the literature review, data analysis, and the outputs of the workshop held with the leading companies of the iron and steel industries in cooperation with the Iskenderun Chamber of Commerce and Industry.

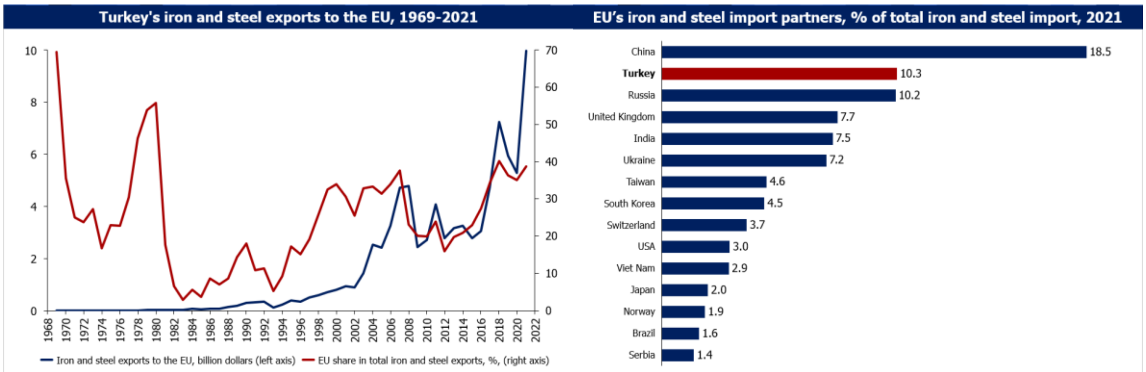
[25] Data, TURSTAT& TEPAV Calculations

[26] IEA (2022), Iron and Steel, IEA, Paris https://www.iea.org/reports/iron-and-steel, License: CC BY 4.0

Iron & Steel Industries in Turkey

2. **As can be seen from Figure 17, Türkiye's iron & steel exports to the EU have been increasing over the years while the share of EU in Türkiye's total iron & steel exports has been fluctuating; yet it has been over 30% in recent years, making EU a major market for Turkish iron & steel industry.** On the other hand, Turkey meets 10.3% of the iron and steel demand of the European Union, ranking Türkiye second among the EU's iron & steel import partners. Considering the damaged relations between the EU and Russia, which meets 10% of the EU's total iron & steel demand, we expect that the importance of the Turkish iron & steel industry for the EU market will increase even more.

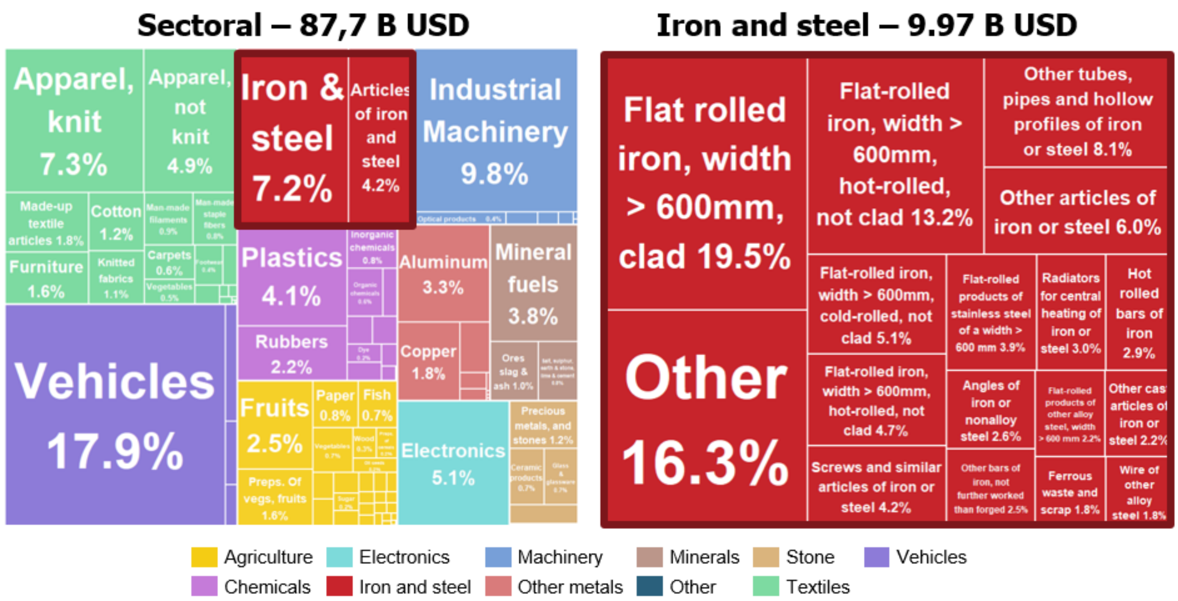
Figure 17. Turkey's Iron & Steel Export to the EU and EU's



Source: TURKSTAT, TEPAV Calculations

3. **The iron & steel sector accounts for 11.4% of Türkiye's export to the EU with around USD 10 billion, making iron & steel the third largest sector** (Figure 18). Among these exported iron & steel products, flat rolled iron varieties with a width greater than 600 mm have the largest share, almost 20%.

Figure 18. Distribution of Turkey's Exports to the EU By Sectors and Products, 2021



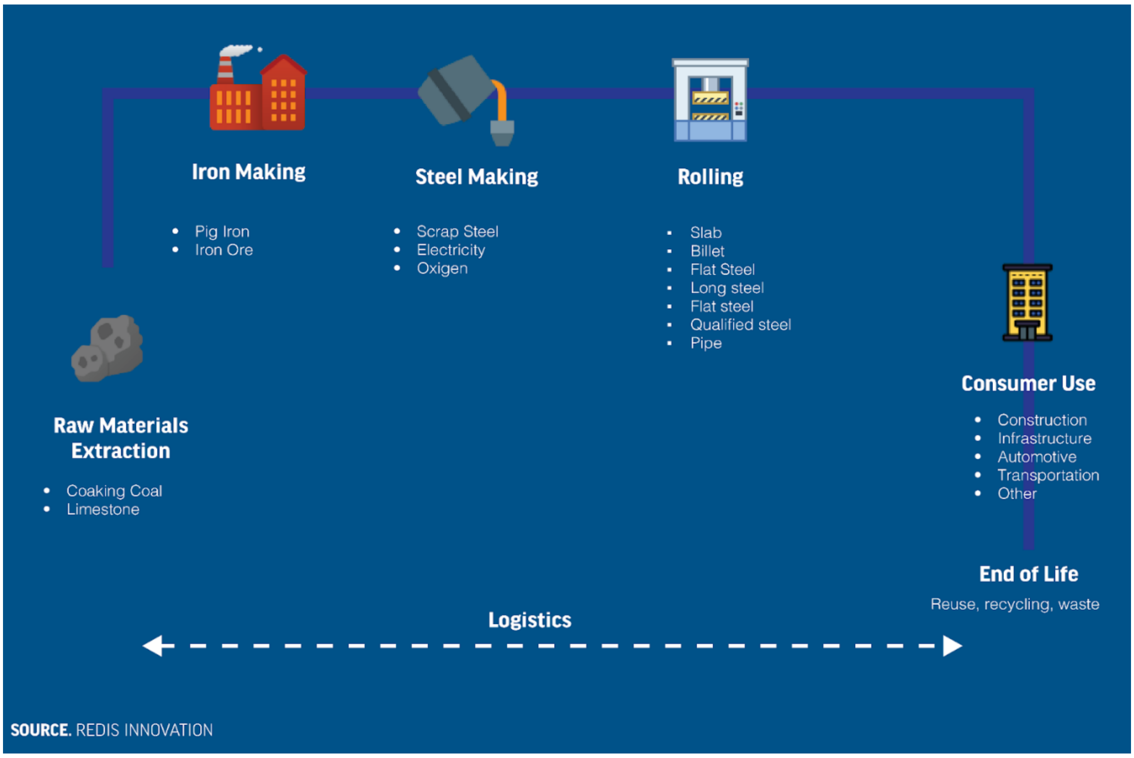
Source: TURKSTAT, TEPAV Calculations

4. **As exhibited in Figure19, the iron & steel value chain begins with the extraction of raw materials such as iron ore, limestone, and coking coal.** The iron making process follows the raw material extraction phase. The refinement of iron ore is the most basic process in the manufacturing of iron & steel. Typically, coal and limestone are utilized in the refinement process. Afterwards, the iron ore goes to the furnaces to produce pig iron. Then steel making phase begins with transferring pig iron to a steel production site.

5. **To produce steel, either a basic oxygen furnace or an electric arc furnace is utilized.** A basic oxygen furnace (BOF), a large piece of equipment, uses pig iron and requires a huge amount of energy, which is usually supplied by coal, so the carbon emissions at this stage are considerably high. On the other hand, electric arc furnaces (EAF), relatively smaller in scale, uses ferrous scrap and electricity as inputs which generates much smoother carbon emissions and eliminates many carbon-releasing stages in iron & steel production. According to the World Steel Association, about 70% of steel is globally produced using the BOF route and the remaining is produced by the EAF. However, this proportion is the other way around in Türkiye. The iron & steel industry in Turkiye heavily uses EAF in steel production by %69[27] which makes this industry relatively less carbon intense.

[27] Turkish Steel Producers' Association, (2021), "Dünya Türk Çeliği ile Şekilleniyor", http://www.cib.org.tr/files/Doc/files/cib2021Katalog_TR.pdf

Figure 19. The Iron & Steel Value Chain



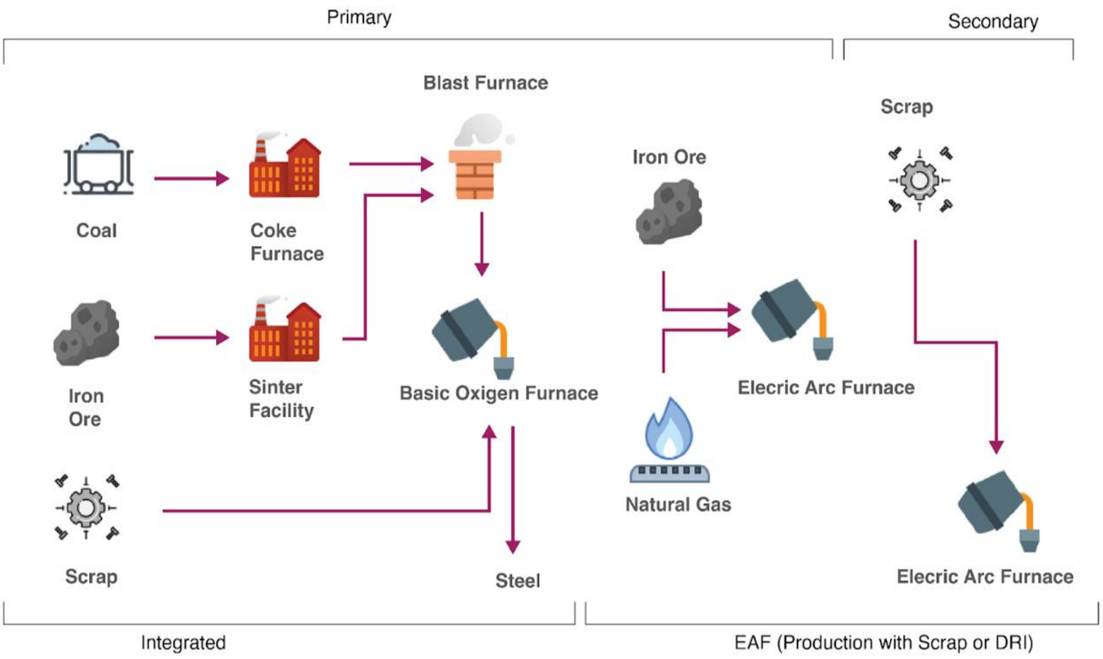
Source: BAT Document for Iron and Steelmaking (2013)[28], ReDis Innovation (2022).

6. **In the following rolling stage of the value chain, the steel is formed into sheets, plates, long steel bars, or pipes, and transferred to the user to be utilized in different sectors.** The crude steelmaking process yields semi-finished goods such as slabs, billets, and blooms. At the consumer use phase, the largest consumers can be listed as the construction sector, the transportation and infrastructure sector, and the automotive sector.

7. **Even though the life cycles of different furnaces have similar structures the process flow changes as seen in Figure20.** Production sites are separated into 3 divisions. Some producers use only BOFs and other companies integrate EAFs into the process. Most of the time, companies that have a high production capacity adopted an integrated production system of these two methods. Companies that use EAFs only are located in the region of Iskenderun and Adana. The aforementioned facilities using this technology have a strong advantage in terms of carbon emissions. In an integrated facility, a blast furnace requires two inputs, which are coke and iron ore. To produce coke, the coal first goes to the coke furnace and then to the blast furnace. Also, the iron ore is prepared for the blast furnace by a sintering process. Then the BOF produces the liquid form of steel, which will be shaped by pouring it into molds.

[28] Joint Research Centre, (2013), Institute for Prospective Technological Studies, Remus, R., Roudier, S., Delgado Sancho, L., et al., *Best available techniques (BAT) reference document for iron and steel production : industrial emissions Directive 2010/75/EU : integrated pollution prevention and control*, Publications Office, https://data.europa.eu/doi/10.2791/97469

Figure 20. The Process Flow in the Iron & Steel Making Industry

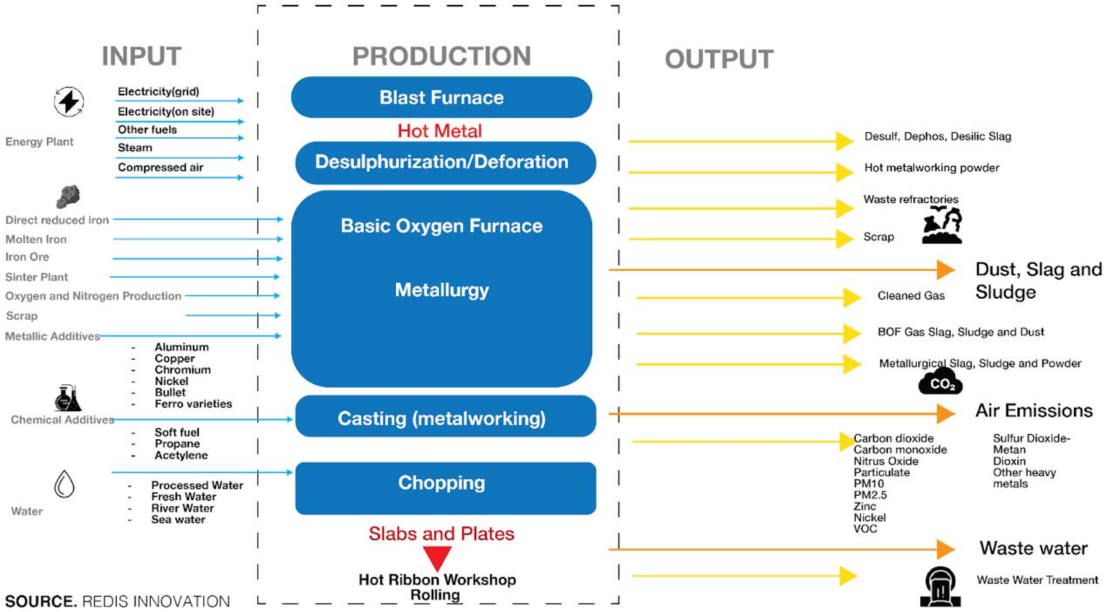


SOURCE. REDIS INNOVATION

Source: Joint Research Centre (2013), ibid, ReDis Innovation (2022).

8. **Sustainability input and output analysis of iron & steel industries are depicted in Figure 21.** Since iron & steel making uses furnaces that should reach very high temperatures, high energy input is required. The production process usually uses electricity, heat from coal, compressed gas or steam, and other fuels as the main types of energy input while iron ore, smelted iron, sintered iron, scrap, and other metallic additions are raw materials. Other heavy metals such as aluminum, ferro varieties, nickel, and corm are also involved in the process. In addition, these processes use water intensively for cooling and washing processes. At the end of the process, these production facilities release emissions and pollutants to the air, water, and soil. Emissions to soil include dust, sludge, slag, metal dust, and solid waste. Among the gasses released into the air, there are many gasses , mainly carbon dioxide, carbon monoxide, and sulfur dioxide. On the other hand, the discharge of water without treatment can cause serious environmental problems and increase emissions as it has residue of metals and chemicals. However, the Turkish Steel Producers' Association states that washing waters are returned to the process after being treated. Approximately 90% of the process water used in some facilities is reused in the process.

Figure 21. Sustainability Input - Output Analysis for the Iron & Steel Industry



Source: WSA (2021)[29], ReDis Innovation (2022).

9. **In Türkiye, the most important emission source is EAF, where 75% of the crude steel production is carried out, and 100% of the scrap is recycled.** Most of the emissions are due to dust and fuel consumption during scrap transport, melting, and casting. The dust that comes out is caught by the dust collection systems with bags. Dust collection systems installed can be enlarged or replaced with new ones to meet the changing capacity needs over time. The dust remaining in the chimneys is given to licensed recycling companies in pellet or powder form to recover the zinc contained in them. Recently, many studies are being carried out in order to convert some of these outputs into inputs for different sectors. The Turkish Steel Producers' Association mentioned that emissions and the usage of raw materials can be reduced by giving one of these applications as an example.

[29] World Steel Association, 2021, Life Cycle Inventory Study, 2020 data release.

10. **Innovative solutions can be employed for reducing the higher emitting parts of iron & steel making processes as illustrated in figure 22.** The first of these solutions is, the EAF itself, which is a technology that has been used since the early 1900s, and it still helps producers to reduce carbon emissions. Since it has been on the market for a long time, it is possible to obtain this technology at competitive prices. By this method, steel is produced from scrap, and many carbon-releasing stages in iron & steel production stages are eliminated. Although the EAF is an electrically powered technology, it can be operated with natural gas which can be another solution to reduce emissions when suitable conditions exist. Scrap, namely DRI, is used as the raw material in EAF operated with natural gas. In particular, many studies have been carried out regarding the usage of slag. It is reported that slag may be turned into an input for cement production and contributes to road-asphalt production. Moreover, slag can be used as a fertilizer and liming in agriculture, it may also be a durable building material especially in constructing sea embankments and can be a raw material in marine afforestation.

Figure 22. Decarbonization solutions for iron & steel production

	Strategy	Examples	Current Look
Electric Arc Furnace (EAO)	Maximizes secondary flows and recycling by melting more scrap in EAFs	EAO – Use of scrap by melting	The technology is readily available at competitive prices.
Using DRI + EAO natural gas	This requires increased use of DRI with EAF.	EAO plants using existing DRI + natural gas	Technology ready, ready to use
Using DRI + EAO H2	DRI replaces fossil fuels in production with hydrogen produced from renewable energy.	MIDREX DRI Process Project HLY DRI Process Project	The technology is affordable to use

Source: McKinsey, 2021[30], ReDis Innovation (2022).

11. **The blast furnaces can also be used as an innovative carbon reducing method for iron & steel production.** In blast furnaces, the use of heat in different units can be converted into steam and electricity, directly reducing carbon emissions. It is also possible to create some products by capturing the carbon and other gasses released during the processes. The new products produced can play an important role in reducing emissions by using them as inputs in different industries as mentioned above. These possible solutions are also summarized in figure 23 below. Overall, there are plenty of challenges for the iron & steel production process in order to minimize carbon emissions. The challenges are concentrated on process efficiency, energy consumption, and reuse or recycling of the outputs.

[30] Hoffman, C. and Zeumer, B., (2021), "Decarbonisation Challenge for Steel", McKinsey Company.

Figure 23. Innovative solutions for iron & steel production

CO2 Reduction	Strategy	Examples	Current Look
Blast Furnace Efficiency	BF/BOF productivity programs. Such programs increase efficiency and/or reduce production losses in different ways.	Optimizing BOF inputs (DRI, scrap), increasing use of blast furnace fuel injection such as hydrogen	The technology is readily available at competitive prices.
Biomass Reduction	Using biomass as an alternative reductant or fuel.		Suitable due to biomass availability in South America and Russia
Carbon Capture ve Use	This uses the emissions to create new products for the chemical industry, such as ammonia or bioethanol.	Producing bioethanol from CO2 emissions	Not yet ready for industrial use

Source: Mckinsey (2021)[31], ReDis Innovation (2022).

12. **During the workshop, participants also referred to the production process and energy consumption as the main emission sources in the iron & steel sector. Apparently, companies prefer to focus more on reducing emissions from the production process within Scope 1, as electricity belongs to Scope 2 emissions.** For instance, some companies focus on efficiency in energy use in the process by applying various methods and renewing old process equipment. Participants also noted that they need to report their Scope 1 emissions within the framework of Monitoring, Reporting, and Verification regulation, so they prioritize decreasing Scope 1 emissions due to legal obligations in Turkey. These attitudes of companies indicate the importance and urgency of the related regulation in Turkey to induce companies to reduce emissions and protect their competitiveness in the EU market after the implementation of CBAM.

13. **Moreover, the industry stressed the difficulty of determining emissions of scrap, used as raw material, specifically in EAF.** The majority of companies import scrap from the EU, the UK, or elsewhere. Although companies receive consultancy in the calculation of scrap emissions by testing in various laboratories, it requires a certain level of investment, which cannot be undertaken in the sub-industry, mostly owned by SMEs. However, the Turkish Iron and Steel Producers' Association has taken a step forward to calculate national scrap emissions, which is a good development, especially for the sub-industry. Although the scrap is sometimes used in BOF, it mainly produces steel from iron ore. As BOF heavily depends on coal, the facilities need to invest in new technologies such as hydrogen to reduce emissions.

[31] İbid, 2021.

14. **Concerning investing in advanced technologies, participants of the SME workshop highlighted the necessity of incentives provided by the State.** For example, they noted that the State may lower the withholding taxes of companies, which invest in new technologies to increase efficiency and decrease emissions. Additionally, the industry participants emphasized the significance of how electricity is generated in reducing Scope 2 emissions. Yet, on various occasions, the high level of carbon-intensive electricity production in Turkey is specifically underlined by participants as coal and natural gas have been heavily utilized in the generation of electricity. They suggested that giving incentives to companies to establish their own renewable energy-sourced power plant not only provides energy security but also increases the percentage of clean energy in Turkey's electricity production, which will be a win-win situation. In the meantime, they accentuated clean energy is crucial in the usage of advanced technology in production. They exemplified that electricity is also used in electrolysis; hence, the cleanness of electricity production will be even more important in the future. Therefore, the incentives need to be directed towards investing in renewables, which will result in a win-win situation.

15. **The steel and iron sector needs to develop and commercialize new low-CO2 technologies within the next 5-8 years in order to be in line with the EU's climate targets.** These sectors can significantly advance the EU's climate objectives as CO2 emissions are concentrated in a limited number of installations that cover about 25% of EU industrial and 5% of EU total CO2 emissions. The technologies required are becoming commercially available and are currently under development in a series of mostly European innovation projects. Although it seems quite distant from the objective outlined by the Green Deal, the iron and steel sector are most advanced among the energy intensive industries in terms of CO2-low projects and the following measures will be applied in the next years:
    - Committed to reducing CO2 emissions by 2030 by 30% compared to 2018 (which equates to 55% compared to 1990) and towards carbon neutrality by 2050, under the right conditions.
    - Will allow the EU to set a global example for hard-to-abate industries that can significantly lower their CO2 emissions in a relatively short period of time.
    - Is a strategic sector producing 100% recyclable, circular materials for the EU's key industries such as automotive, mechanical engineering, CO2 low energy industries, construction, household goods, packaging, medical devices, sanitary systems, defense, among others.

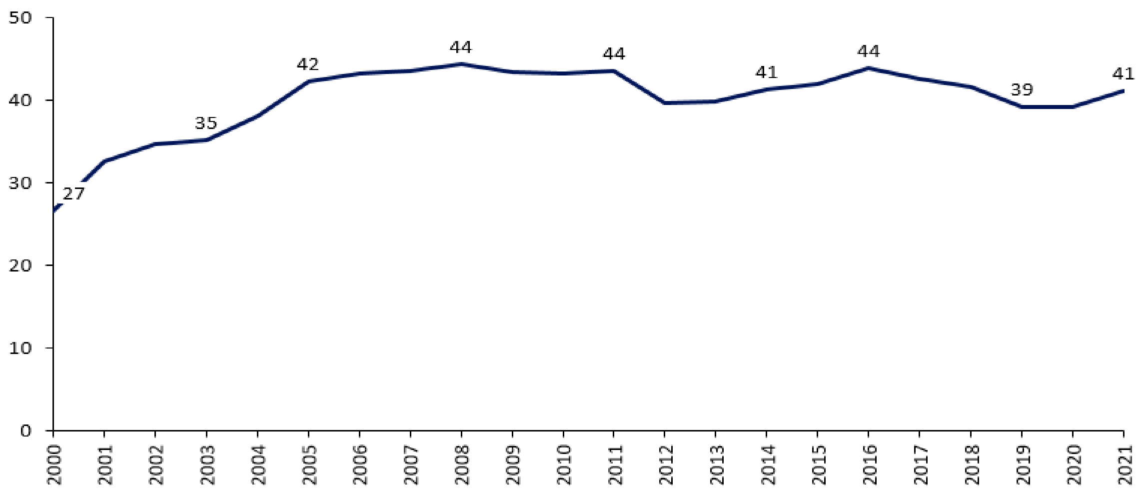
Plastics & Packaging Value Chain

1. **In 2015, plastics caused 4.5% of global GHG emissions.** If the world keeps consuming plastic packaging at the current rate, by 2050 there will be more plastic than fish in the ocean by weight. Most plastic packaging is used only once, and 95% of its value, estimated at 80-120 billion dollars annually, is lost to the economy after its initial use. Packaging is one of the main users of virgin materials as 40% of plastics and 50% of paper used in the EU is destined for packaging. Without action, the EU would see a further 19% increase in packaging waste by 2030, and for plastic packaging waste even a 46% increase. Moreover, most of the produced plastic has a linear nature in the European economy, where only 12% of materials and resources are currently brought back into the economy.

2. **Türkiye's plastic packaging exports to the EU in 2021 is approximately $1.5 billion, corresponding to 41% of its total plastic packaging export as seen in Figure 24 below.** Considering the total emissions of the sector and the size of the exports from Turkey to the EU, the plastics packaging industry occupies an important place within the framework of the European Green Deal. With a value chain methodology, we compiled an integrated report comprising differentiating dynamics and structural indicators of these two industries**.** In this context, first, we describe a general Green Deal impact framework for the plastics & packaging value chain. Then, we analyze plastics & packaging industries' current trends in Türkiye and give an overview on sustainability indicators of the value chain. Finally, we present primary recommendations and further projects for green transformation in the plastics & packaging value chain. In this report, we combine the literature review, data analysis, and the outputs of the workshop held with the leading companies of the plastics & packaging industries in cooperation with the Kocaeli Chamber of Commerce and Industry.

3. **Türkiye makes approximately 40% of its total plastic exports to the EU-27 .** Especially between 2000 and 2005, the share of plastic packaging export to EU-27 has increased by 15% and settled in the 40%.

Figure 24. Türkiye's Plastic Packaging Export to the EU

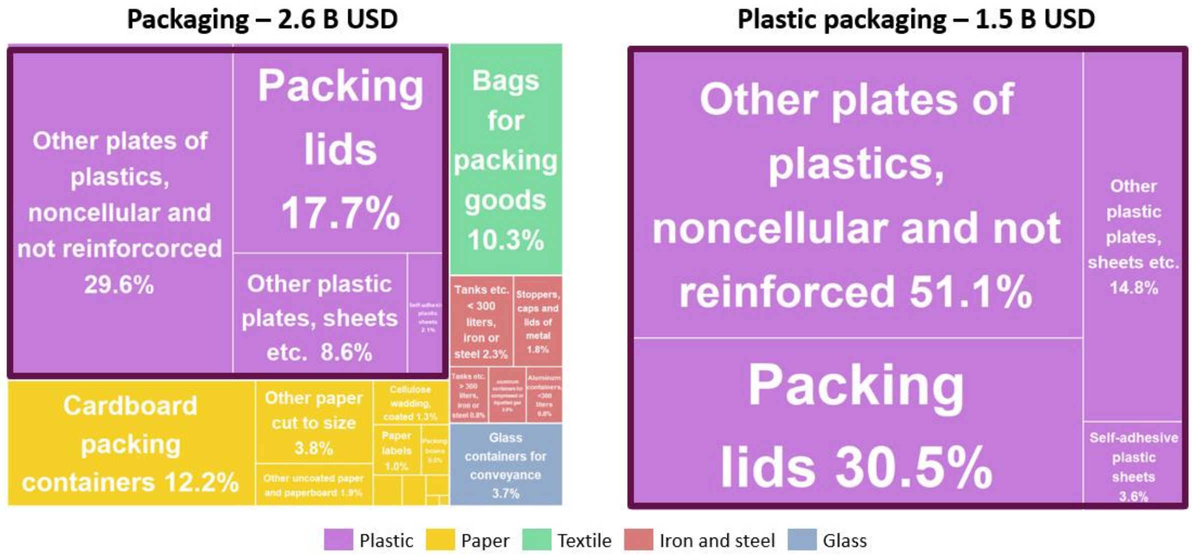


Source: TURKSTAT, TEPAV calculations

Plastics & Packaging Industries in Türkiye

4. **As can be seen from Figure 25 plastic packaging has the greatest share in Türkiye's total packaging export to EU-27.** Among plastic packaging, noncellular and not reinforced other plates of plastics and packaging lids constitutes around 82% of total plastic packaging export to EU-27.

Figure 25. Distribution of Turkey's plastic packaging exports to the EU by products, 2021

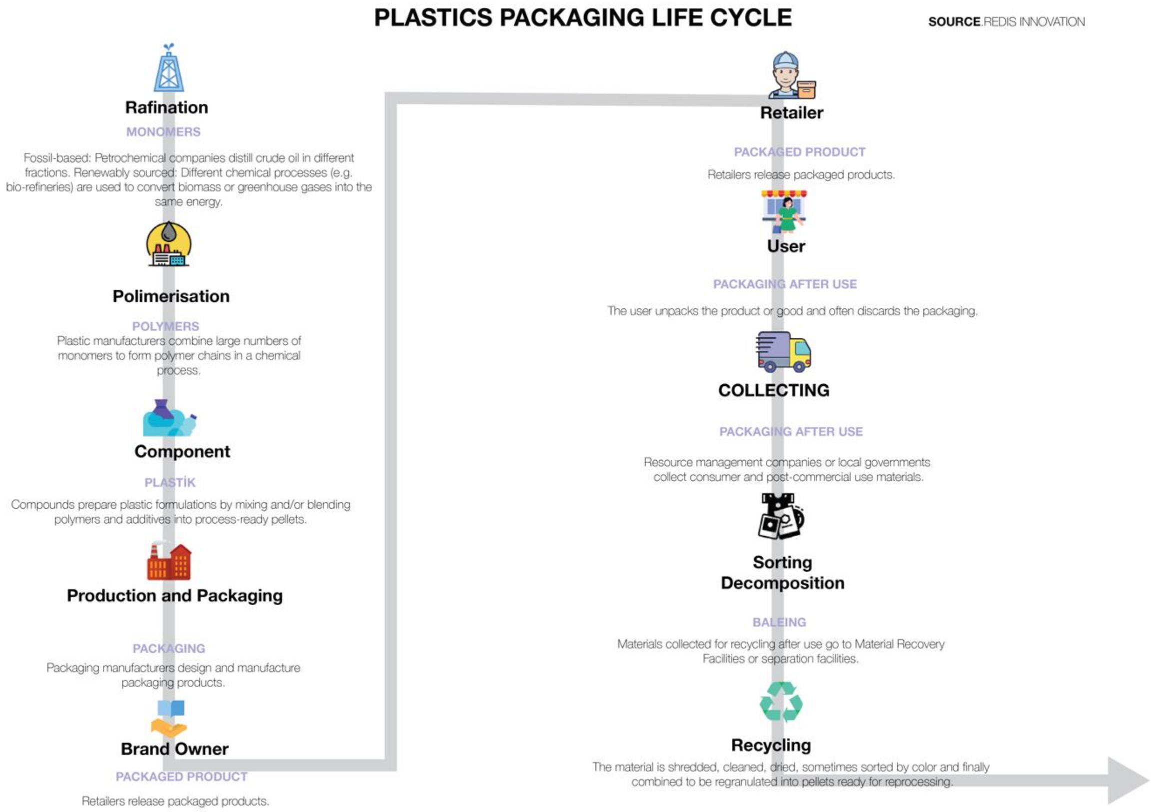


Source: TURKSTAT, TEPAV calculations

General Overview of Plastic Packaging Industry Value Chain and Sustainability Indicators

5. **The value chain of plastics & packaging industry is exhibited in Figure 26.** The first leg of the process is the extraction of oil and rafination/refinery. Oil is transformed into a polymer which is the main raw material of plastics production. The plastic life cycle ends at the component stage and the process continues with the packaging industry. In the production and packaging stage, the plastics turn into plastic packages, such as bottles, boxes, and other containers, at the packaging production facilities. The plastic packages are transported to the brand owners to cover (or package) their products. Later, the brand owners transport the final packaged and branded products to the retailers, mostly located at the center of the cities. Retailers deliver the received product to the users by in store sales or inter-city cargo delivery.

Figure 26. Plastics & Packaging Value Chain



Source: Ellen MacArthur (2021)[32] and ReDis Innovation (2022).

6. **The plastic used by the user becomes waste. Therefore, the processes of gathering, destruction, and transformation of so-called plastic waste start at this stage.** Plastic waste and packaging collected by local government, private companies, or waste workers are baled in the sorting and decomposing phase. Then, it is disassembled in recycling facilities and the plastic raw material is extracted again. However, at this stage, the separation of waste can be very energy and time demanding. In recycling, normally a labor-intensive process, sorting can be done by robots using machine learning, but this requires high technology investment.[33] Figure 27 shows how much plastic products are used by sectors, through an illustration. According to Figure27, the rate of plastics produced for packaging goods and products corresponds to 44% of the total plastic production in the world. The packaging industry is followed by the construction industry with 18%. Then, the textile sector gets the third place by around 13% due to the use of polymer as a resource for synthetic textile products. These sectors are followed by consumer products, transportation and aviation, and electronics industries, respectively.

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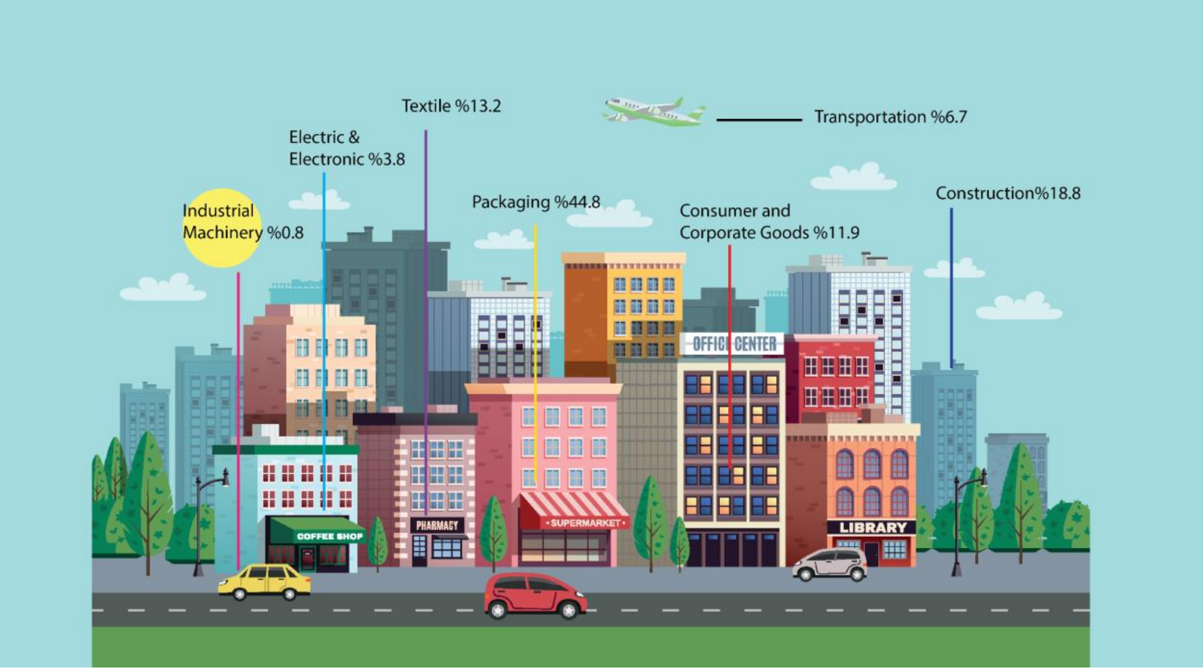
[32] World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company, The New Plastics Economy — Rethinking the future of plastics (2016, http://www.ellenmacarthurfoundation.org/publications).
[33] Kennrick Cai at Forbes, 2020, Rise of the Recycling Robots, https://www.forbes.com/sites/kenrickcai/2020/11/12/rise-of-the-recycling-robots/?sh=2992df4a65f9

Figure 27. Plastic Usage Rates by Sector



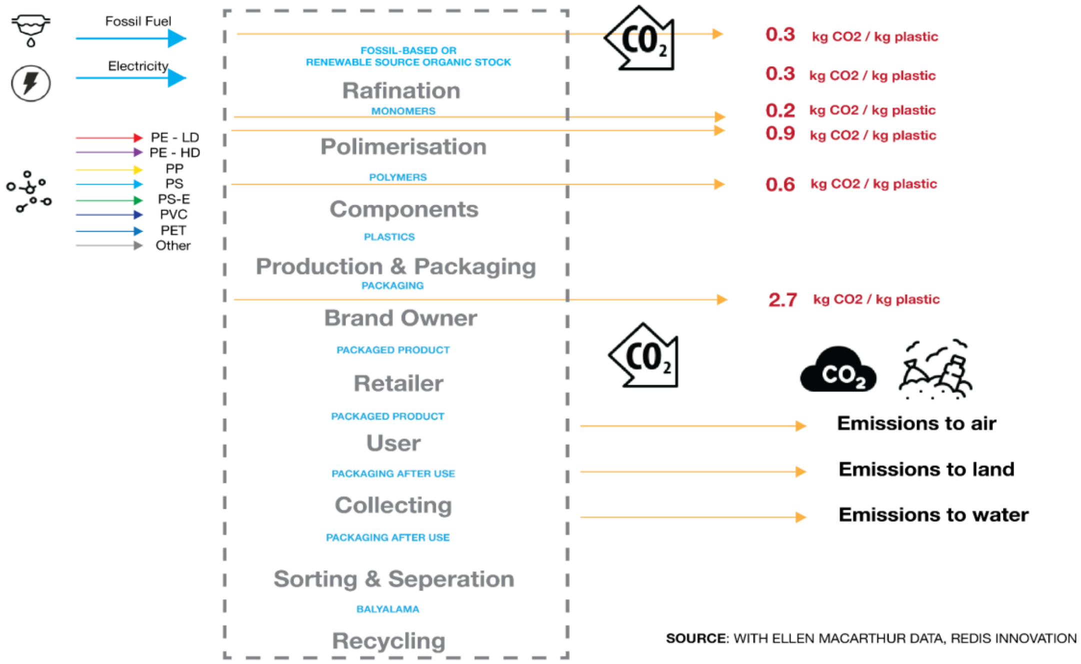
Source: UNEP, 2021[34] and ReDis Innovation (2022).

7. **Figure 28 corresponds to the sustainability inputs and outputs analysis for the plastics and packaging sectors.** The industry employs fossil fuels and electricity as the main sources of energy. Moreover, there are many polymers and monomers employed as raw materials. The raw materials go through a process of rafination, polymerization, and component supplementation. Each process emits a certain amount of carbon dioxide per kilogram of plastics as seen from Figure 28.

8. **Substantial levels of carbon emissions may also occur in post-production processes.** A significant amount of plastic is dumped in the ground or pumped into water each year. Globally, this year alone, researchers estimate that the production and incineration of plastic will pump more than 850 million tonnes of GHG emissions into the atmosphere. Therefore, designs that would make products more durable and able to be used more than a couple of times have a critical impact on the environment. A loop of recycling or reuse would prevent the production of more plastics and also cut the emissions from dumping in the ground or leaking into the seas.

[34] UNEP, Addressing single use of plastic products pollution, 2021. https://www.lifecycleinitiative.org/wp-content/uploads/2021/02/Addressing-SUP-Products-using-LCA_UNEP-2021_FINAL-Report-sml.pdf

Figure 28. Sustainability Input & Output Analysis of Plastics & Packaging Industry



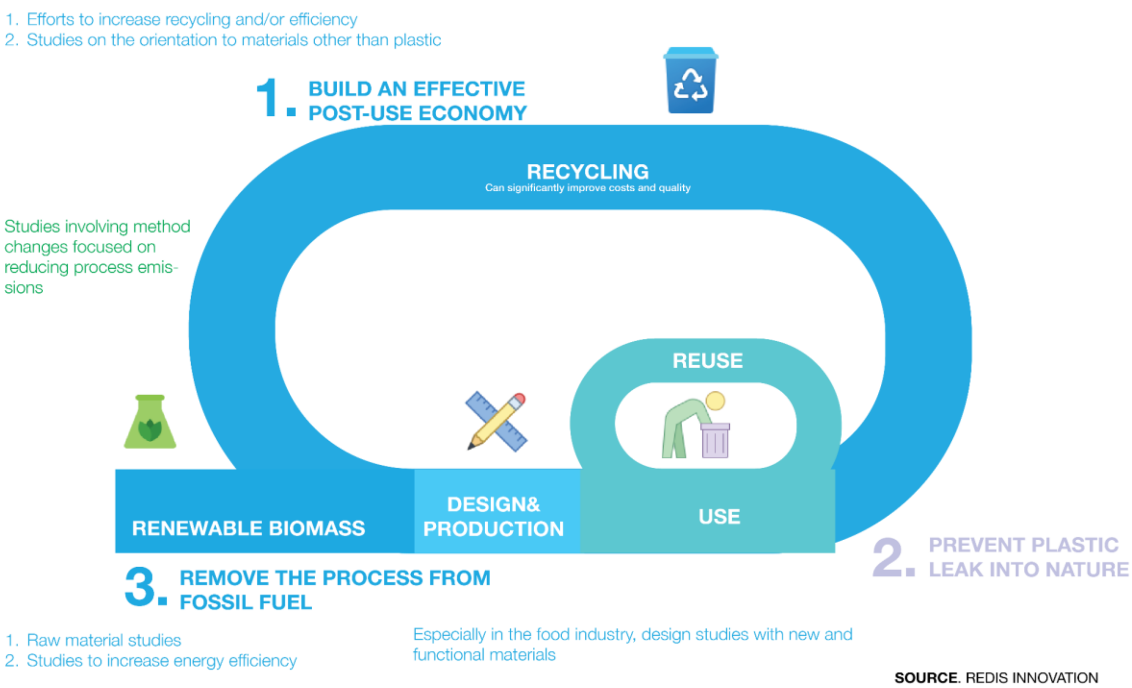
Source: Ellen Macarthur (2021)[35] and ReDis Innovation (2022).

Green Transformation in the Plastics & Packaging Industry

9. **Even though millions of tons of GHG emissions are currently being pumped into the environment, there is a strategic plan to prevent most of it.** The plan includes three actions that would involve processes in design, removal, and reusing steps, which are schematically represented in Figure29. The first action is building an effective post-use economy. This action corresponds to the activities under recycling. Plastic products that cannot be reused should be collected, sorted, and transferred to recycling centers. The second part arises from the responsibility of the producer companies towards nature. In other words, producers must take responsibility to prevent spills into nature. Not producing single-use plastics or working with customers who care about recycling can be listed as responsible actions of companies. Especially at this stage, tons of emissions can be prevented as a result of encouraging reuse together with design studies.

[35] ibid, 2021.

Figure 29. Three Actions for Design, Removal & Reuse of Plastics



Source: Ellen MacArthur (2021)[36] and ReDis Innovation Visualization (2022).

10. **The final set of actions include measures to decarbonize the production process.** The use of renewable biomass in the production of raw materials, the use of other renewable energy sources, and other efforts that will increase energy efficiency in raw materials will contribute to decarbonization significantly. Actions to be developed under this strategic plan will increase the level of competition between plastics and packaging manufacturers compared to other manufacturers.

11. **During the workshop, participants stressed on the importance of data availability to conduct sectoral value chain analysis.** One of the participants openly stated that "if you cannot measure it, you cannot manage it". With that knowledge, some companies prefer to work with specific suppliers who have strong corporate structure supporting them to collect relevant data to calculate carbon footprint. Considering SME oriented structure of the plastic packaging sector, the difficulty of reaching relevant and accurate data becomes even more prominent to provide sustainability in the sector.

[36] Ibid, 2021.

12. **For consumers, the new actions will ensure reusable packaging options, get rid of unnecessary packaging, limit overpackaging, and provide clear labels to support correct recycling.** For the industry, they will create new business opportunities, especially for smaller companies, decrease the need for virgin materials, boosting Europe's recycling capacity as well as making Europe less dependent on primary resources and external suppliers. They will put the packaging sector on track for climate neutrality by 2050. The Commission also brings clarity to consumers and industry on biobased, compostable and biodegradable plastics: setting out for applications where such plastics are truly environmentally beneficial, and how they should be designed, disposed of and recycled. The proposals are key building blocks of the European Green Deal's Circular Economy Action Plan and its objective to make sustainable products standard.

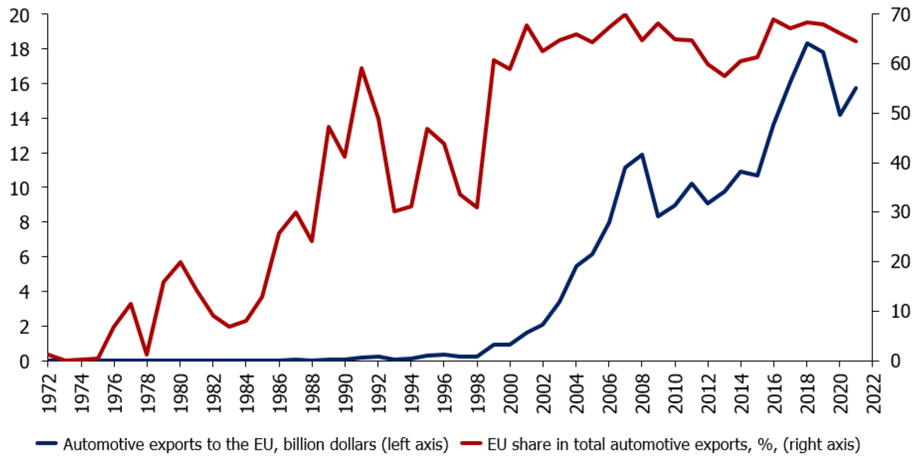
Automotive Value Chain

1. **While the automotive industry is one of the most significant economic sectors by revenue, it has obvious negative effects on the environment due to requiring a substantial number of materials, such as plastics, rubber, glass, and steel, for vehicle production and combusting fossil fuels during the use phase.** Considering these extensive impacts of the industry, its sustainability gains more importance globally. With the value chain methodology approach, we compiled this report for the automotive industry. In this context, first, we describe a general EU Green Deal impact framework for the automotive industry value chain. Then, we analyze the automotive industry's current trends in Türkiye and give an overview of sustainability indicators of the value chain. Finally, we present primary recommendations and further projects for green transformation in the automotive industry. In this report, we combine the literature review, data analysis, and the outputs of the workshops held with the leading companies of the automotive industry in cooperation with the Bursa Chamber of Commerce and Industry. Bursa has key importance in terms of the automotive sector in Turkey.

Automotive Sector in Türkiye

2. **The automotive industry is crucial for the Turkish economy as it accounts for 18% of Türkiye's total exports to the EU.** The EU also has the biggest share in Türkiye's total automotive exports with almost 70%, corresponding to around $16 billion as shown in Figure 30 below. Many automotive manufacturers and automotive spare industry manufacturers such as TOFAŞ, OYAK Renault, and Karsan run their operations in Bursa. The city also hosts TOGG, which will be Turkey's first domestically produced electric car. Companies from 152 countries are the customers of the automotive industry in Bursa which accounted for exports of $6.7 billion in 2021. EU member states constitute 4 of the top 5 exporting countries from this city. Therefore, the workshop was hosted by the Bursa Chamber of Commerce and Industry, and more than 20 industry representatives attended this workshop.

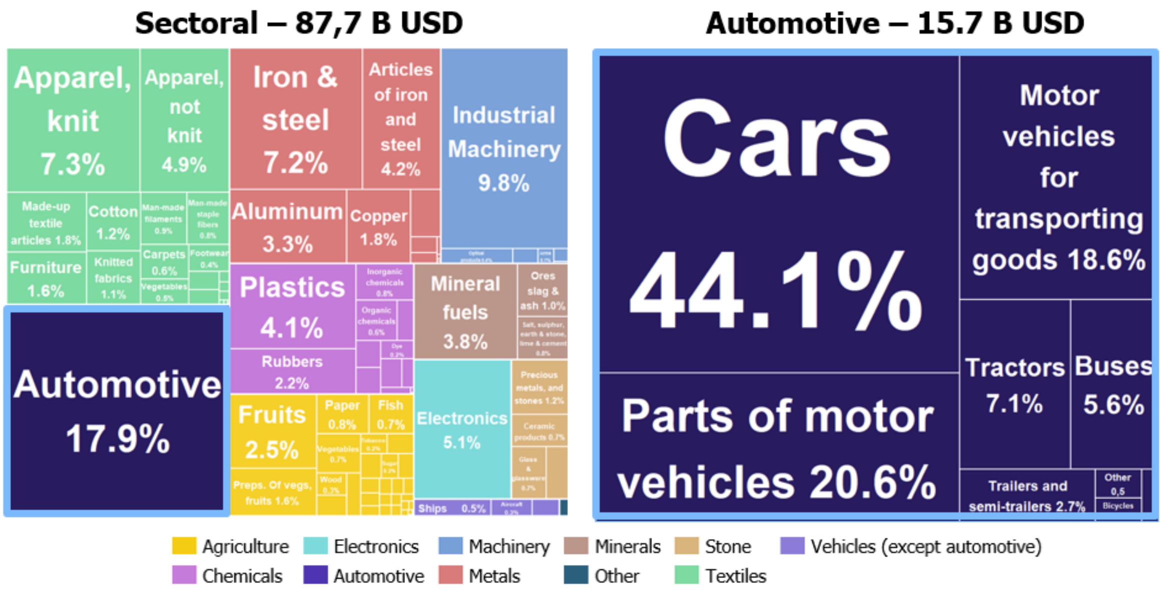
Figure 30. Türkiye's Automotive Exports to the EU, 1969-2021



Source: TURKSTAT, TEPAV calculations

3. **The automotive sector ranks second in total exports to the EU, with around 16 billion dollars by 2021.** In the automotive sector level of exports to the EU, cars have the highest share with 44.1%, followed by parts of motor vehicles with 20.6%. In other words, cars and parts of motor vehicles combined constitute the backbone of Türkiye's automotive exports to the EU with around 65% share.

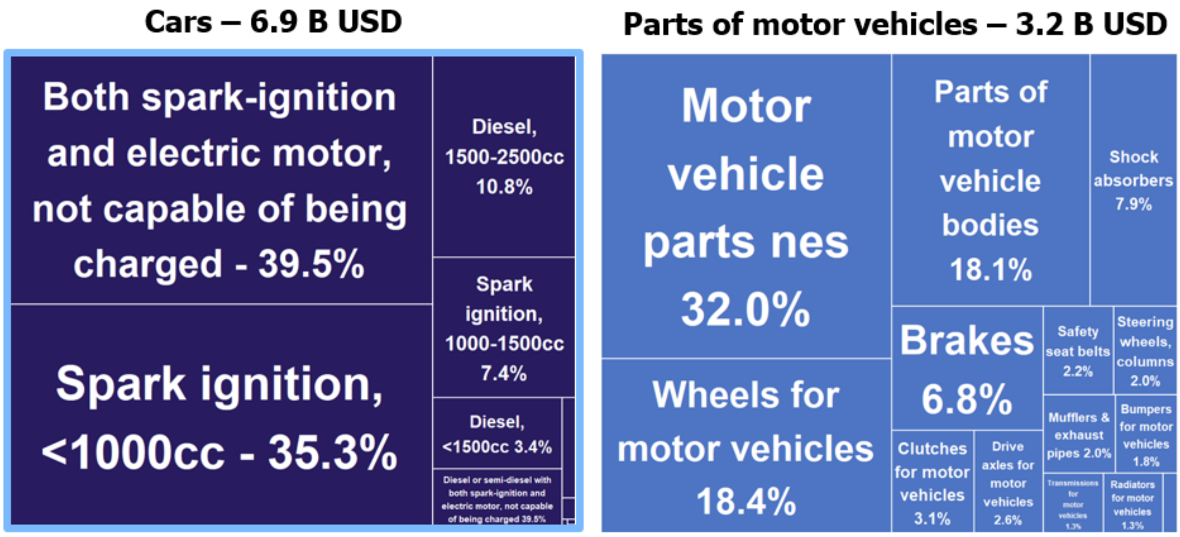
Figure 31. Distribution of Türkiye's Exports to the EU by Sectors and Products, 2021



Source: TURKSTAT, Author's Calculations and Visualizations

4. **Hybrid cars and cars with spark ignition of less than 1000cc motors account for approximately 75% of total car exports to the EU in 2021 as exhibited in Figure 32** Türkiye exports bodies, wheels, brakes, and various engine vehicle parts to the EU. The parts of the motor vehicles sector are a crucial export industry for the Turkish economy as it has an export share of 20.6% in the automotive industry and 3.7% in Türkiye's total exports to the EU (Figure 31).

Figure 32. Distribution Of Türkiye's Cars and Parts of Motor Vehicle Exports to the EU, 2021

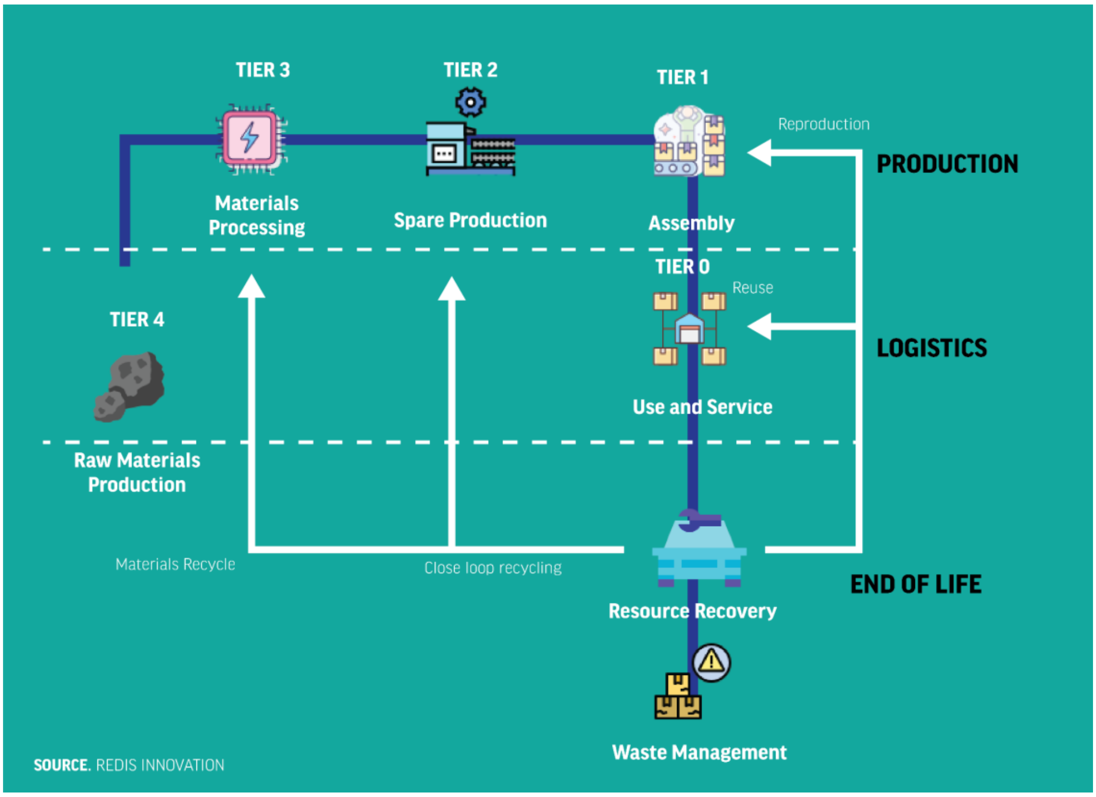


Source: TURKSTAT, Author's Calculations and Visualizations

General Overview of Automotive Industry Value Chain and Sustainability Indicators

5. **The value chain of the automotive industry is described in Figure 33. There are 7 stages in the value chain, including recycling.** The first stage is the procurement of raw materials such as steel, plastic, and glass. Since the emissions of each raw material are included in the life cycle of an automotive product, using the best quality and environmentally friendly inputs will significantly reduce emissions. This also applies to motor oils, chemicals, and alkalis used at different stages of the value chain. In the second stage is material processing, the aim is to process the raw materials obtained and bring them into appropriate forms for further phases. The following stage is spare production, the activity of compounding the materials to turn them into functional forms. The spare production is followed by the assembly stage which is the final part within the production facility's system boundaries. Yet the life cycle of the product continues through use, maintenance, resource recovery, and waste management phases.

Figure 33. Automotive Industry Value Chain

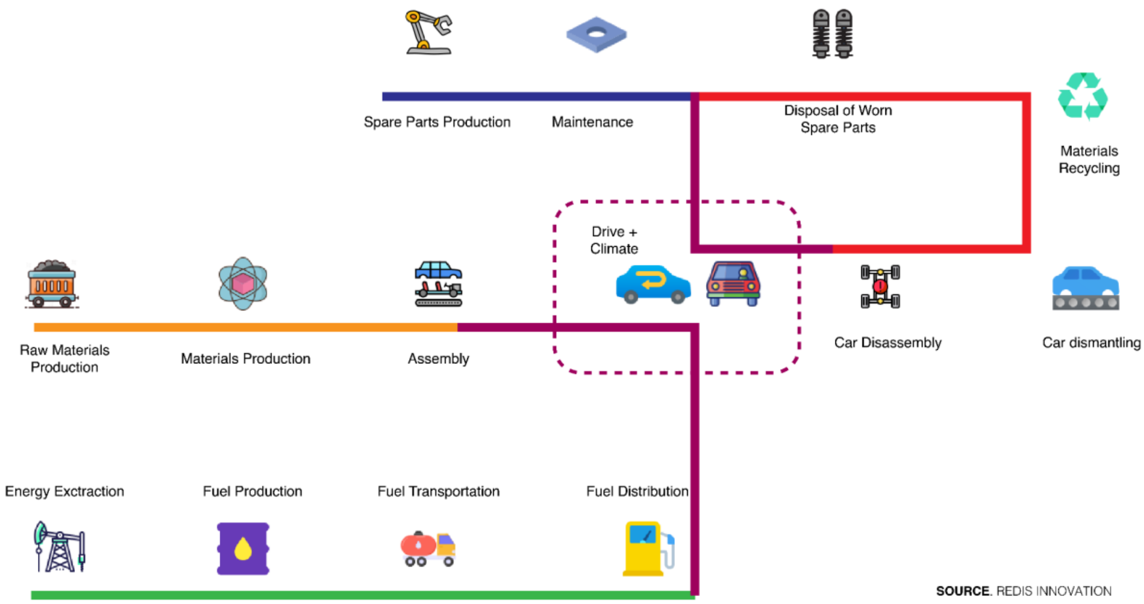


Source: Spitzley, Keoleian (1999), Chanaron (2007)[37], ReDis Innovation (2022).

6. **The flow of the processes and actors after a car is on the roads is somewhat different** (Figure34). There are 5 main clusters of actors in the flow of the automotive production process. Three clusters that take place around the procurement, processing, and assembly of materials are the stages where we focused on by examining the life cycle for the automotive sector. At the end of the production stage, the car is ready to use, driving. At this stage, an entire separate sector develops for supplying fuel. The extraction, processing, and distribution of fuel is a cluster that takes place outside of automotive production; however, substantially affects emissions as the fuel consumption of a car accounts for a massive part of the total carbon emissions, up to 75%. Conventional use of cars, which is the main source of fuel emissions, is expected to be reduced after an expansion in the electric vehicle market.

[37] Jean-Jacques Chanaron. Life Cycle Assessment Practices: Benchmarking Selected European Automobile Manufacturers. International Journal of Product Lifecycle Management, Inderscience, 2007, 2 (3), pp. 290-311. ff10.1504/IJPLM.2007.016293ff. ffhalshs-00205034ff

Figure 34. Process Flow and Industry Actors for Automotive

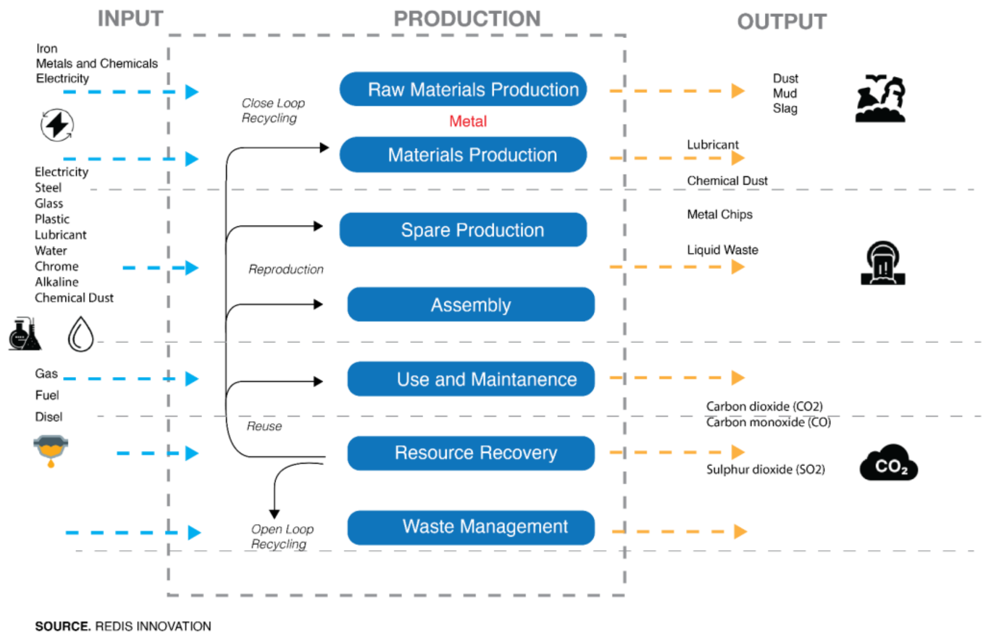


Source: Spitzley, Keoleian (1999), Chanaron (2007)[38], ReDis Innovation (2022).

7. **The inputs and outputs for the automotive production process for sustainability analysis are presented in Figure35.** In the first stages, basic raw materials, such as iron, steel, and chemicals are used together with other inputs such as energy and water, to form the intermediate products, to be used in automobile production. In addition, the raw materials that are used for engine production, interior design, and windows of cars are plastic, glass, and other metals, such as chrome. During the production phase, lubricants, metal powders, liquid wastes, and metal chips may be disposed of as outputs. Automobiles are run by fuel, which is also the main input, resulting in emission outputs, such as carbon dioxide, carbon monoxide, and sulfur dioxide. Besides, during the life cycle of the automobile, used spare parts for maintenance and repair, used covers, plastic and metal parts scrapped can be seen as outputs.

[38] ibid, 2007.

Figure 35. Sustainability Input and Output Analysis for Automotive Value Chain



Source: Spitzley, Keoleian (1999), Chanaron (2007)[39], ReDis Innovation (2022).

8. **Carbon emissions in the production of conventional and electric cars are substantially different from each other.** Figure 36 reveals the comparison of total emissions of electric and traditional cars**.** Production of electric vehicles is not only good for the environment due to the reduction in fossil fuel emissions, but also innovative for the automotive industry. However, as seen in Figure36, producing electric vehicles may not directly meet the challenge of a zero-carbon production line by 2050. In contrast, the production phase of an electric vehicle causes three times more carbon emissions than traditional motor vehicles. Although the production of conventional vehicles emits less carbon dioxide, electric vehicles have a high potential to reduce emissions caused by the use phase. Overall, the total carbon emissions are compatible for now. At a time when the leading brands of the industry promise to be completely carbon zero by 2050, these figures are “thought-provoking” in terms of meeting the targets.

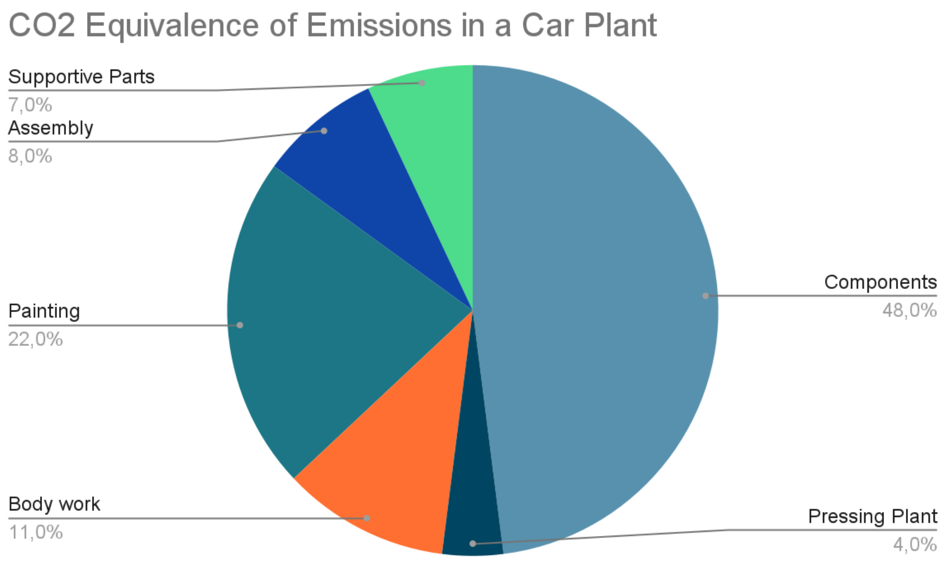
[39] ibid, 2007.

Figure 36. Comparison of Total Emissions of Electric Car and Traditional Car

Source: WEF

9. **The distribution of total carbon emissions that may occur in different departments of the factory during the production phase of a conventional vehicle is depicted in Figure 37.** Accordingly, the most emitting unit is the components department with 48%, followed by the painting department with a share of 22%. These departments are followed by body work, assembly, and supportive parts, respectively.

Figure 37. CO_2 Equivalent of Emissions in A Car Plant

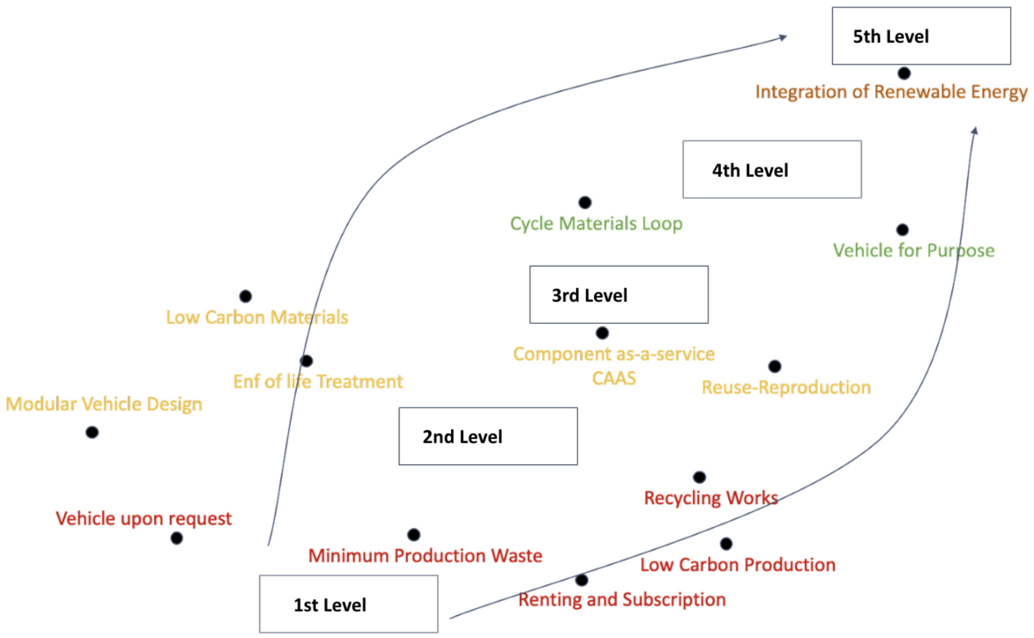


Source: Spitzley, Keoleian (1999), Chanaron (2007)[40], ReDis Innovation (2022).

[40] ibid, 2007.

10. **There are steps that need to be taken immediately and in the long-term for automotive companies to reduce emissions.** A report published by Accenture Strategy[5] suggests that there are 5 levels of circularity for the companies which means effectiveness in the value chain, supporting fleet creation, and coordination. The circularity levels are set up according to their availability, costs, and timing. Level zero corresponds to no circularity; level 1 refers to low circularity and level 2 applies for the processes with moderate circularity. According to this study, level 3 steps need to be ensured until 2025. Moreover, the steps after level 3 are equal to the level of high circularity and net positivity in the system by the year 2040. All these levels and related solutions are presented in Figure 38.

Figure 38. Innovative Solutions for the Automotive Industry on the Road to Carbon Zero



Source: Accenture Strategy, (2020)[41].

[41] Accenture Strategy, 2020, World Economic Forum. Raising Ambitions: A new roadmap for the automotive circular economy

11. Employing an effective waste management system and low carbon production are primary measures that need to be taken into consideration for automotive industry. Limiting production levels could be possible with producing vehicles by order and providing car rental services. Such business organizations can reduce car production that is over the market demand, and keep carbon emissions at lower levels. Component, as a service, is a strategy that aims to rent some components of the car instead of buying. On the third level, a modular design for cars needs to be adopted. Thus, policies such as reusing some parts of the vehicle and end of life treatment should be constituted in a structural manner. Full circularity level requires a cycle loop of materials, producing cars for a purpose and integration of renewable energy to the grid. Overall, switching to electric car production alone or relying solely on renewable energy sources may not be enough. Innovation in the processes, materials, and designs used by companies, and energy types should also be integrated into all cycles.

12. The transport sector accounts for 27 % of total CO2 emissions in the EU, with almost half of these being attributed to passenger cars and the automotive industry. In order to meet the Paris Agreement 1.5 ◦C target and the Green Deal, these figures call for interventionist policies that go beyond individual consumer choice and transform industrial sectors. The proposed CO2 by the European Green Deal targets the reduction of 55% of the emissions by 2030 (based on 1990's levels). Although very challenging, the proposed measure will significantly speed up the structural transformation of the automotive value chain and take the EU to a path free of emissions. The value chain mitigation of GHG will help the automotive sector to gradually reduce its emissions, since the production machinery and final product are intimately connected to other industrial meshes.

Agriculture and Food Value Chain

1. **The entire food system, from farm to fork, generates around 21 to 37% of global GHG emissions.**[42] Agriculture is responsible for 10–12% of greenhouse gas emissions worldwide, the figure rising to 25% when land clearing and indirect emissions from the manufacturing of chemical compounds are included. The industrial production of mineral Nitrogen fertilizers through the Haber–Bosch process alone consumes 1–2% of global energy production and 4–5% of methane extracted worldwide. Considering the total emissions of the agriculture and food sectors and the size of the exports from Türkiye to the EU, the industry is important within the framework of the European Green Deal, specifically the Farm to Fork Strategy.[43] Within the value chain methodology approach, we produced an integrated report comprising differentiating dynamics and structural indicators of these two industries, namely agriculture and food. In this context, first, we describe a general Green Deal impact framework for the agriculture and food value chain. Then, we analyze the agriculture

[42] Mbow, C., Rosenzweig, C., Barioni, L. G., Benton, T. G., Shukla, [P R, Skea, J., Calvo Buendia, E., Masson-Delmotte, V., Pörtner, H.-O., Roberts, D. C., Zhai, P., Slade, R., Connors, S., van Diemen, R., Ferrat, M., Haughey, E., Luz, S., Neogi, S., Pathak, M., … Malley, J. (2019). Food Security. In *Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*.

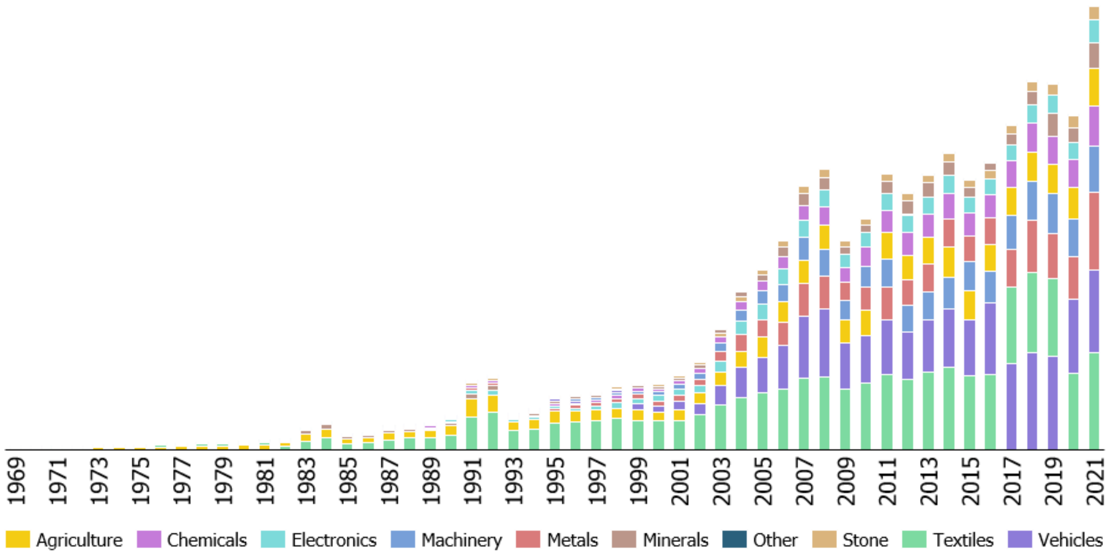
[43] European Commission. (2020). Farm to Fork Strategy, https://food.ec.europa.eu/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

and food industries' current trends in Türkiye and give an overview of sustainability indicators of the value chain. Finally, we present primary recommendations and further projects for green transformation in the agriculture and food value chain. In this report, we combine a literature review, data analysis, and the outputs of the workshops held with the leading companies of the agriculture and food industries in cooperation with the Antalya Chamber of Commerce and Industry and the Aegean Region Chamber of Industry.

Agriculture & Food Sectors in Türkiye

2. **Agriculture and food sectors are still major sectors in exports to the EU,** despite the share of exports of food/agricultural goods have decreased compared to total exports as Turkish machinery, iron & steel, and vehicle sectors have entered to the European markets (Figure 39).

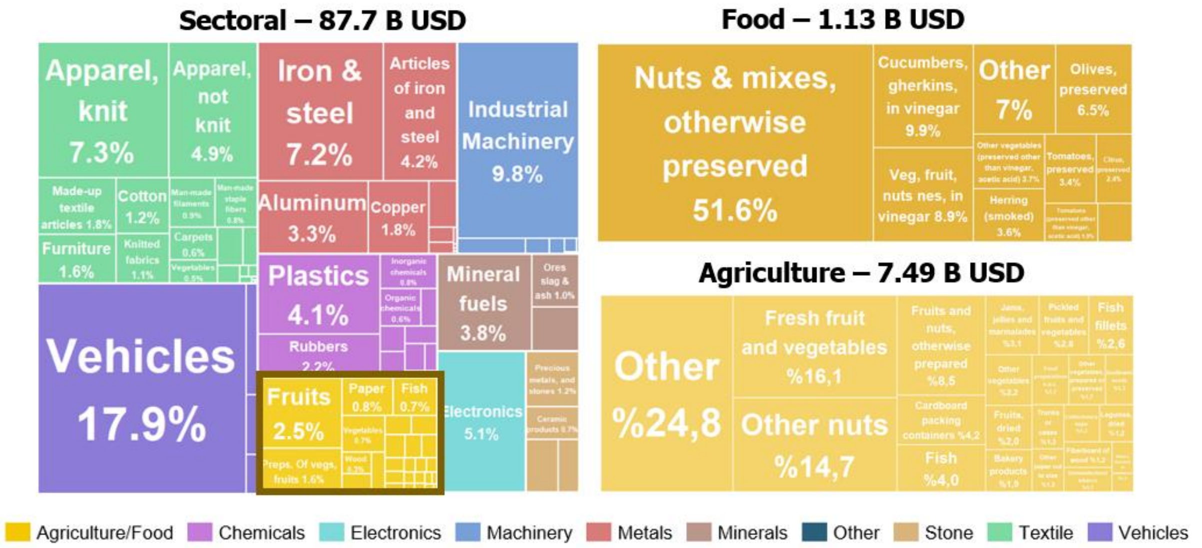
Figure 39. Türkiye's exports to the EU by sectors, 1969-2021



Source: TURKSAT and TEPAV Calculations

3. **While the economy in Türkiye heavily depended on agriculture back in the mid-century, agriculture and food sectors are still prominent in Türkiye as they have a relatively big share in the total exports of the country.** As exhibited in Figure 40, the agricultural goods export of Türkiye is around 8.5% and food export 1.3% of total exports of Türkiye to the EU. Preserved food, especially preserved nuts, has the biggest share in total food export to the EU. On the agriculture side, fresh fruit and vegetables together with nuts accounts for 30% of the total agricultural goods export to the EU. Consequently, the focus of the workshops was on fresh fruit and vegetable in agriculture and preserved food in the food industry.

Figure 40. The Distribution of Türkiye's Export of Agriculture & Food Industry to the EU, 2021

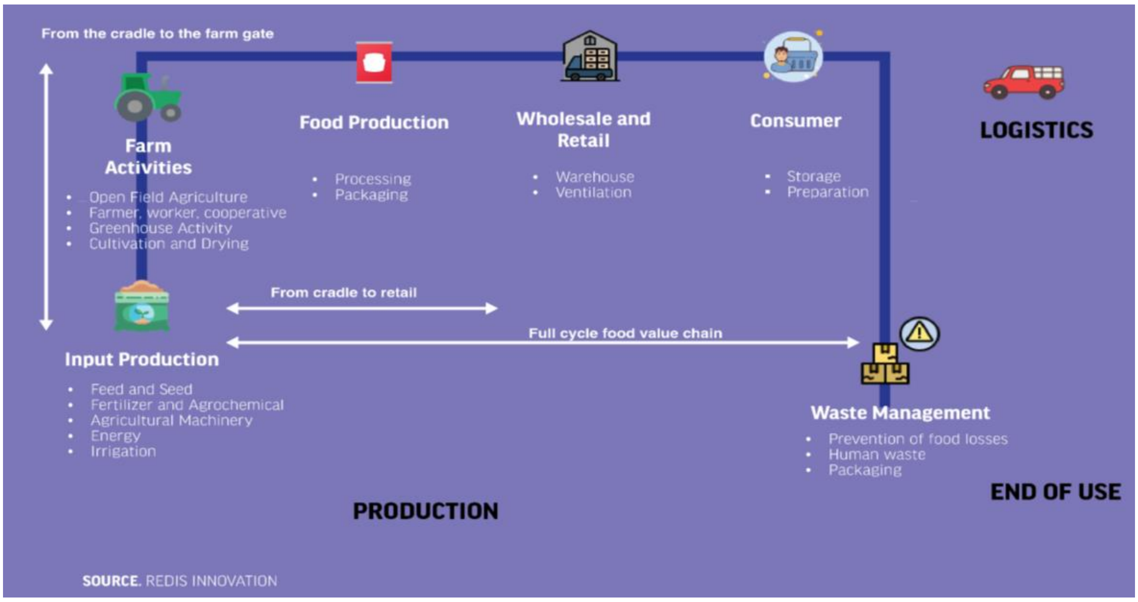


Source: TURKSTAT, Author's Calculations and Visualizations

General Overview of Agriculture & Food Value Chain and Sustainability Indicators

4. **The value chain of the agriculture and food industry starts with the production of inputs which are feed, seed, fertilizer, and agrochemical materials.** On the other hand, energy and irrigation are other inputs for agricultural production. The emissions from the production of inputs should also be added to the overall value chain as it is crucial to choose the right products from the beginning. After acquiring the required inputs, the activities on the farm can be enumerated as cultivating and drying in open field agriculture by farmers, workers, and cooperatives. The agricultural products in the fields are harvested and transferred to the food processing units. After food reception phase that removes dirt on the vegetables or fruits, they are ready for the cooking process.

Figure 41. Agriculture and Food Industry Value Chain



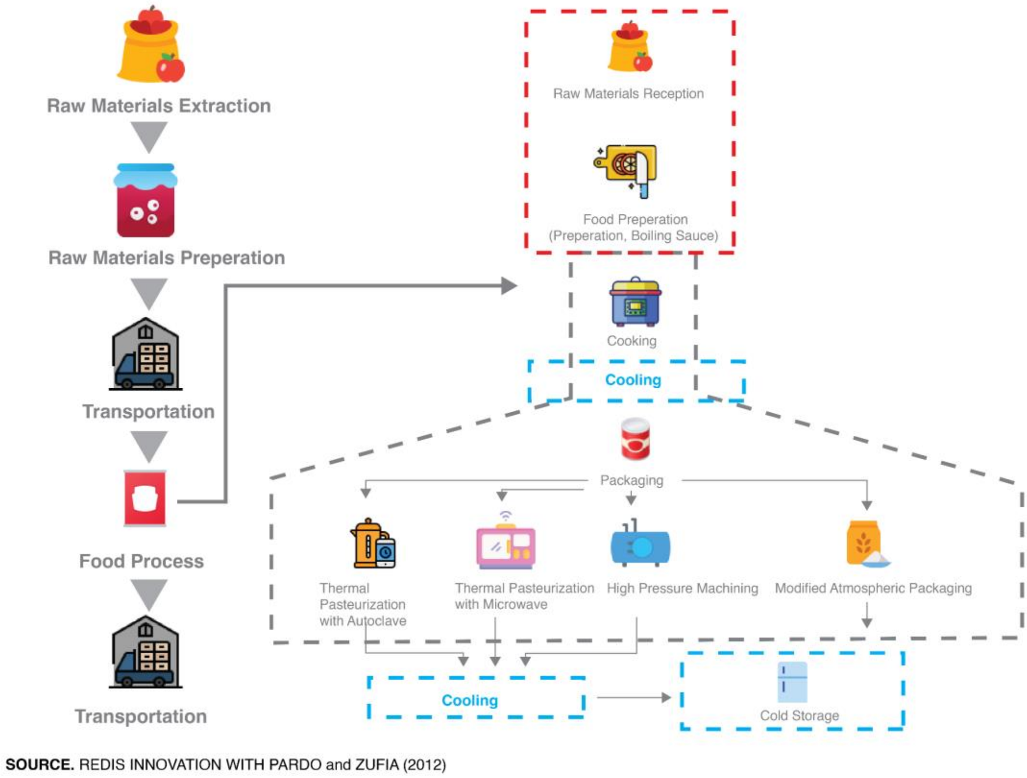
Source: BAT for Agriculture and Food Industry[44], Redis Innovation (2022).

5. **The value chain of agriculture and food can be separated in the food production step.** Although the food value chain continues with the processing of agricultural goods, agricultural products such as fresh fruits and vegetables are also directed to wholesalers and retailers. Then these fresh fruits and vegetables are purchased by the consumers, as well as hospitality sectors such as hotels, restaurants, and catering companies, purchased to be prepared for consumers. These phases are illustrated in Figure 41 above. Apart from emissions by transportation, kitchen activities and the use of water contribute to emissions in this stage. Effective waste management system to reuse water and goods for other purposes to prevent the overuse of natural resources is crucial at this stage. Therefore, efficient wastewater management systems would make companies more competitive in terms of the European Green Deal.

[44] European Commission, Joint Research Centre, Giner Santonja, G., Brinkmann, T., Raunkjær Stubdrup, K., et al., *Best Available Techniques (BAT) reference document for the food, drink and milk industries : Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control)*, Publications Office, 2020, **https://data.europa.eu/doi/10.2760/243911**

6. **The steps in the food production stage of the food value chain gain more importance in terms of reducing emissions.** The flow of food processing is shown in Figure 42. The very first steps of the food processing industry are the food reception and the preparation of food for the following processes. At this stage, water, chemicals, and other food products that are used need to be more efficiently used. However, these tasks are labor intensive and are handled with daily interventions. Food processing continues with the cooking and cooling phases. Then the process is finished with packaging which is divided into two parts, pasteurization, and atmospheric packaging. Pasteurization is handled by three different methods, which are thermal pasteurization with autoclave and microwave, and high-pressure machining. Then the production is finalized with cooling of the packaged foods to keep the food consumable for longer times, i.e., prolonging its life.

Figure 42. The Flow of Food Processing



Source: Pardo and Zufia (2012)[45], Redis Innovation (2022).

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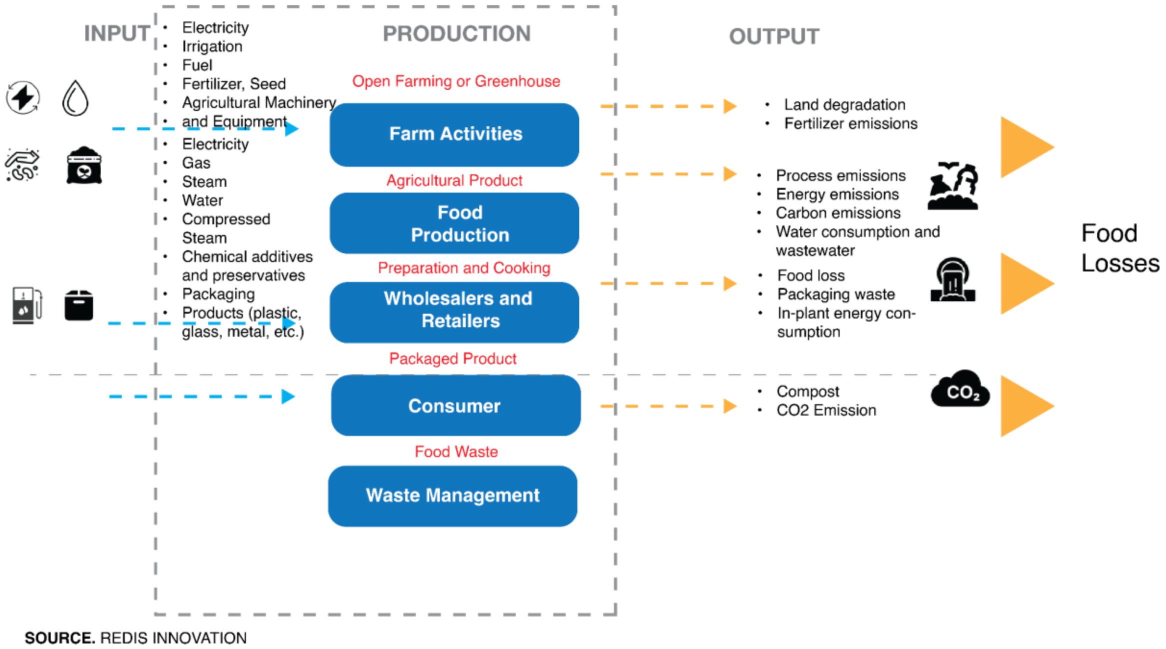
[45] Guillermo Pardo, Jaime Zufía, Life cycle assessment of food-preservation technologies, Journal of Cleaner Production, Volume 28, 2012, Pages 198-207.

7. **The inputs and outputs of the agriculture and food sectors are explained in Figure 43.** The main inputs of farm activities are electricity, irrigation, fuel, fertilizer, seed, pesticides, and agricultural machinery. Overuse of any of the inputs could have a negative impact on the soil cultivated by decreasing the organic support while creating pollution of freshwater. Organic farming does not require these inputs so it will be beneficial, especially in terms of reducing emissions. In the workshop held with the representatives of the agricultural sector, it was observed that some farmers have already taken steps in this direction. For instance, a farmer, who is also an agricultural engineer with a master's degree, in Antalya stated that he obtained the manure from his animals and used it as organic fertilizer that doubled the soil quality by stopping the use of pesticides. He also asserted that he was ready to share his knowledge and experience. Then he added that incentives for green transformation should be increased, and a road map should be prepared to increase soil quality and decrease pesticide use.

8. **In the processes of food production, electricity, natural gas, and steam are the main sources of energy.** A significant amount of water is also required depending on the size of the production. One participant of the workshop, who was the manager of one of the biggest pickle production companies in Izmir, added that they currently use municipal water and conduct a research project on how to reuse the pickle water. He underlined that wastewater is treated before being released into nature. He also shared one of their research & development projects, which aims to prevent pickle juice from being thrown away during consumption, as it is drinkable. Culturally, it is common in Türkiye to drink pickle water.

Figure 43. Sustainability Input and Output Analysis of the Agriculture and Food Industry Value Chain



Source: BAT for Agriculture and Food Industry[46], Redis Innovation (2022).

9. **Fertilizers play a leading role in emissions to the soil and cause land degradation** (Figure 43). The effect of fertilizers is rather complex. Extensive use of fertilizers causes the depletion of scarce resources in the form of nitrogen and phosphorus and damages water quality while it generates GHG.[47] Considering that arable land is a limited resource, land degradation due to fertilizer use should also be taken seriously. Additionally, food loss and waste are serious problems that take place at every stage of the value chain. Globally, one third of food is lost or wasted throughout the entire food value chain.[48] For instance, food can be wasted just because of aesthetic concerns even if it is fresh and edible. However, it is possible to reuse these foods as inputs for producing different products. Preventing, donating, using as animal feed, recycling, and recovering at every stage of the value chain can dramatically reduce emissions by saving food from being wasted.[49] For instance, composting is a way of recovering food that can no longer be used at all. Composts increase soil quality and may help to reduce using other inputs such as fertilizers.

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[46] ibid, 2020.

[47] World Bank, (2020), "Addressing Food Loss and Waste: A Global Problem with Local Solutions", https://openknowledge.worldbank.org/bitstream/handle/10986/34521/Addressing-Food-Loss-and-Waste-A-Global-Problem-with-Local-Solutions.pdf?sequence=1&isAllowed=y

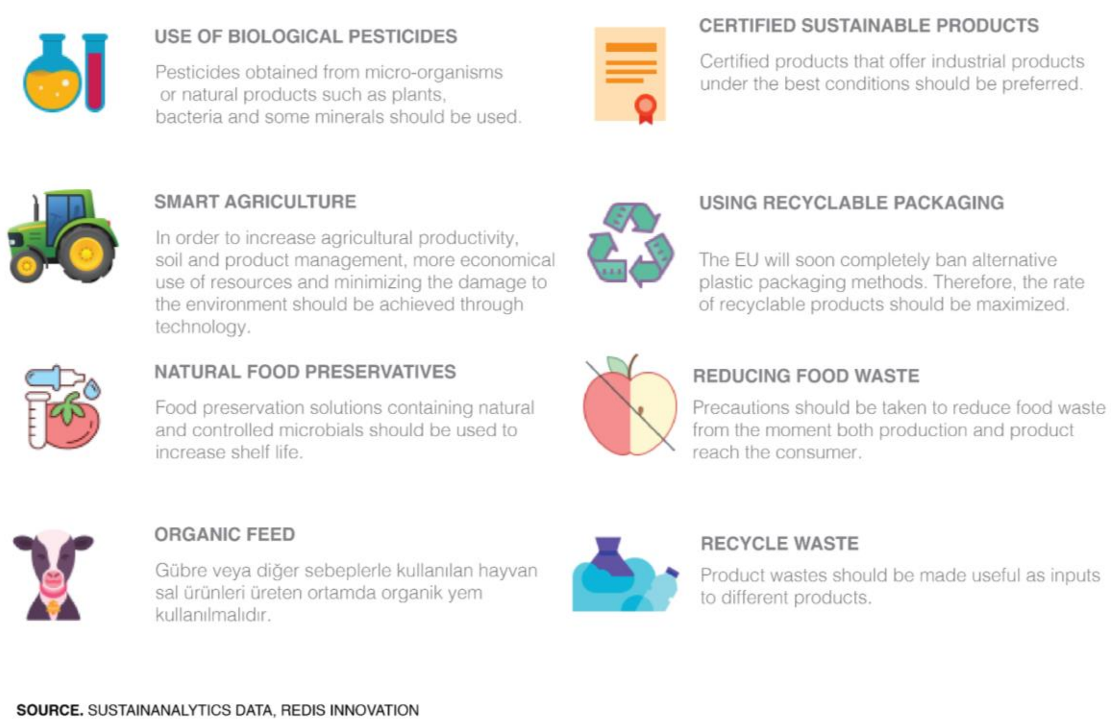
[48] FAO, (2011), "Global food losses and food waste - Extent, causes and prevention", http://www.fao.org/3/i2697e/i2697e.pdf

[49] European Commission, (n.d.), "Food waste measurement", https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste/food-waste-measurement_en

Green Transformation in Agriculture and Food Value Chain

10. **There is a list of strategies that can be used to help reduce emissions in farming and food processing activities, illustrated in Figure 44.** First, pesticides derived from natural products such as microorganisms, plants, bacteria, and some minerals can bring real value to agricultural operations. Second, land and product management, resource conservation, and minimization of environmental damage should be achieved through productivity-enhancing technologies. Third, natural and controlled microbial should be used to increase shelf life for food preservation. Fourth, organic feed should be used in environments where animal products are used for fertilizer. Fifth, certified products should be preferred when industrial products are acquired. Next, the packaging should be climate friendly by not containing any plastics which the EU will ban soon. Finally, various measures should be taken to reduce food loss and waste from production to consumer use stages.

Figure 44. Innovative Ways of Reducing Emissions in Agriculture and Food Sectors



Source: Sustainalytics (2022), World Economic Forum (2020)[50] Redis Innovation (2022).

[50] Nature Risk Rising is published by the World Economic Forum in collaboration with PwC. It is the first in a series of reports from the New Nature Economy project, 2020. https://www3.weforum.org/docs/WEF_New_Nature_Economy_Report_2020.pdf

11. **The workshops held with farmers and food producers were guiding in terms of revealing emission-intensive stages in the sector and understanding the applicability of innovative practices.** One of the farmers stated that the soil must complete its clean and organic processes for vegetables and fruits, which are raw materials for food to grow in a healthy environment. According to this view, while the organic content in the soil should be at least 5%, in Antalya, the province where the workshop was held, this figure does not even reach 2%. According to the farmer, this indicates a negative situation that could lead to desertification, and immediate action is needed. Moreover, the same farmer has stated that he has started to take precautions against desertification in his farm activities. In this context, the farmer mentioned that the aim is to prevent the use of chemicals and pesticides, and use less water and energy, then emissions can be reduced. He also mentioned that support should be provided by the state and other interested parties for the implementation of these measures. As an example of one of these practices, he mentioned that he used the waste obtained from the animals raised in a different place as fertilizer in his field.

12. **The European Green Deal sets an action plan to solve the current problems of emissions based F2F sets an action plan to accelerate and facilitate the transition towards a sustainable food system encompassing production, distribution, and consumption.** Notably, it sets quantitative targets for 2030 concerning some key environmental aspects of agriculture:
    - To reduce the overall use and risk of chemical pesticides by 50% and the use of more hazardous pesticides by 50%.
    - To reduce nutrient losses by at least 50% while ensuring no deterioration in soil fertility. Achieving this is also estimated to reduce the use of fertilizers by at least 20%.
    - To reach 25% of the cropped area under organic farming. Regarding agricultural land, the target is to bring back at least 10% of agricultural area under high-diversity landscape features.

13. **Food supply chains and agribusiness systems are well established and coordinated food systems.** This leads to competition not only between individual companies in a food chain but also to competition between supply chains and networks.It is well known that in the food chain agriculture is connected with other non-plant based foods. In this way, in a general way of looking at the food chain, one can see that the treatment, transport, animal feed, storage, displacement to distribution networks until reaching the final consumer requires improvements in both emissions and natural resources.

14. **As a result of these trends, research on developing new models for food markets is required**. It is possible to see a continuous increase in consumers' demand for food safety and its functionality. In addition, consumers require product diversity, higher packaging quality, and the quality of services. Moreover, it is necessary to consider the simultaneous environmental and socio-economic impact of food waste and food loss reduction. The announcement of the Green Deal makes the adoption of a circular economy model and best practices a must for nowadays. For consumers, they will ensure reusable packaging options, get rid of unnecessary packaging, limit overpackaging, and provide clear labels to support correct recycling. For the industry, they will create new business opportunities, especially for smaller companies, decrease the need for virgin materials, boosting Europe's recycling capacity as well as making Europe less dependent on primary resources and external suppliers. They will put the packaging sector on track for climate neutrality by 2050.

15. **The Commission also brings clarity to consumers and industry on biobased, compostable and biodegradable plastics: setting out for which applications such plastics are truly environmentally beneficial, and how they should be designed, disposed of and recycled.** The proposals are key building blocks of the European Green Deal's Circular Economy Action Plan and its objective to make sustainable products the norm. They also respond to specific demands of Europeans as expressed at the Conference on the Future of Europe. Preventing packaging waste, boosting reuse and refill, and making all packaging recyclable by 2030:
    - Apply advanced technologies in agri-food: drones, smart IoT, AI, upscaling real-time sensor data, 5G and edge solutions for remote farming
    - Cross-benefit analysis
    - Potential market exploration, roadmap for adoption of technologies

III. General Evaluation and Next Steps

1. **The Green Deal goals represent an ambitious yet feasible vision for society.** Achieving these goals will, however, require significant effort and business transformation. The Eurochambres network consists of Chambers of Commerce in the EU Member States. The Chambers have been following the portfolios presented by the Green Deal and Fit for 55, have experience and expertise in supporting business transition, and are developing and implementing plans to further support their business members in this transition. The Green Deal presents Eurochambres and Türkiye with opportunities for collaboration, aimed at supporting Turkish businesses align with Green Deal goals. Participation of Turkish Chambers of Commerce in Eurochambres working groups and other fora through which projects are conceptualized and developed. Participation costs, mainly personnel and travel costs, would be low and covered through internal or national funds. This would allow the Turkish Chambers to participate in the ideation, conceptualization and development of cross-border Green Deal projects, with the aim of being partners to such projects.

2. **Where existing EU funded projects are of interest to Turkish businesses, the Turkish Chambers of Commerce could be supported to mirror existing projects, allowing for these Chambers to partner with consortia, implement approved work plans, and provide Turkish businesses with the support and networking opportunities presented through such projects.** Costs would vary depending on the project's work plans. While new partners can't normally join existing EU funded projects, if external support is provided to collaborate with the project consortium, this would nevertheless afford the Turkish Chambers the opportunity to bring the knowledge from existing EU projects to Turkish businesses. A recent example is the Energy4SMEs, a 3-year long project by 23 Eurochambres members aimed at supporting 1,000+ SMEs increase their energy efficiency, funded under the EU's LIFE instrument, and awarded in 2022. This project builds on other projects in which the consortium members participated, such as the HORIZON STEEEP Project, and the IMPAWATT project. Another example of a project that can be mirrored to Turkey is the development between national chambers of a hydrogen roadmap as it occurs in Portugal.

3. **Türkiye is considered a widening country eligible for participation in the EU's Hop On funding for existing HORIZON projects.** This facility affords Turkish businesses the ability to apply for EU funding capped at EUR 500,000 to join an already approved HORIZON project, subject to conditions. EUREKA is another EU funding stream for which a R&D collaboration between a Turkish business and an EU MS business are eligible. There is the opportunity for the Chambers of Commerce in Turkey and Eurochambres members to identify funding streams for which Turkish and EU businesses are eligible, identify businesses within the sectors listed in this report for which the streams are relevant, and carry out matchmaking and capacity building exercises for these businesses to develop and present project proposals under these strands.

4. **Availability of finance is critical for businesses to meet the investment requirements of a transition in line with Green Deal objectives.** Turkish institutions and the EU could provide instrumental information in assessing the economic capacity, needs, and gaps that businesses face in evolving to meet Green Deal objectives, as well as indications of solutions aimed at bridging any gaps. Potential studies include listing transition opportunities needed for a set of businesses, the environmental benefits to such opportunities, the financing required and an analysis of financing gaps. The information arising out of such analysis could serve to inform private and public financing measures or financial instruments. Implementation gap studies focused on technologies/practices that could drive Green Transition, between EU MS Chambers with experience in thematic areas & Turkish institutions, chambers and firms. Similar to the above financing gap studies, an implementation readiness study could serve to identify key areas for improvement, state of play, quantifying number of businesses for which particular technologies are applicable, awareness and intentions of the businesses towards the technologies, and additional support required to foster a widespread adoption.

5. **It is important to note that this study is only the beginning of what needs to be done, tip of the iceberg, regarding EU Green Deal which is the new growth strategy that aims to transform the EU economy and the society to put it on a more sustainable path.** Türkiye being an important export and import partner of the EU, and in its value chains must take an initiative to rethink policies for clean energy, industry, construction, transport, food and agriculture. We have passed the stage of awareness raising, it is now necessary to delve into the circular production of each sector, then each product, in order to have the greatest impact in reducing the carbon, and water footprints, and waste to water and soil.

6. **In this respect, we identified the sectoral impact framework for these most exposed sectors (with a value chain approach) through "Digital data collection and analysis" based on sustainability indicators.** But when doing this, as pointed out in the report, it is understood that even on the same value chain of a sector the carbon emission of each product changes. For example when we are analyzing the garment industry, when cotton textiles are used, the carbon emission due to cotton production via fertilizer and water use is very high. Whereas the use of synthetic fibers, and recycled polyester or innovative materials reduces the environmental impact of the industry. But the main resource used in the production process of garments, whether from cotton textiles or synthetic and recycled materials, is electricity. There again the energy used in the production of electricity is the determinant factor in carbon emissions.

7. **All this brings us back to the importance of studying each product's value chain on its entirety, and the necessity for a public - private sector dialogue.** In all the workshops conducted the participants pointed out the necessity, the importance, and urgency of related regulation in Türkiye, prepared by the ministries, to induce companies in reducing emissions and protect their competitiveness in the EU market after the implementation of CBAM. But to do this, measurement of carbon emissions, water footprints, and waste to water and soil must be conducted, and the impact of each input, production process, and output on these must be assessed. So if the companies producing these products use the methodology suggested, it would provide very valuable input for the development of necessary regulations by the ministries. In this process, the ministries can provide incentives for the related industries and companies to speed the process. This dialogue, and collaboration will not only ease the way to the reduction of emissions, but be the source from which the very costly probable investments in new production facilities, and machinery will be financed, via an access to green financing.

Annex I

The EU's Ordinary Legislative Procedure

The Green Deal and Fit for 55 represent a suite of legislative and policy updates at EU level. The EU's Ordinary Legislative Procedure, through which EU legislation is formed and adopted, is described below. Each policy point forming part of the Fit for 55 goes through this process individually, and hence each legislative item can be at a different stage in its formation, to other elements within the Fit for 55 package. Following this section, which introduces the general procedure, an overview of the progress is provided for the individual elements of the Fit for 55 package.

Step 1: The European Commission submits a legislative proposal to the European Parliament

Step 2: 1st EU Parliamentary Reading. Parliament will either approve or request amendments.

Step 3: 1st EU Council Reading. Council will either approve or request amendments.

Step 4: 2nd EU Parliamentary Reading. Parliament will either approve or request amendments.

Step 5: 2nd Council Reading. Council will either approve or request amendments.

Step 6: The Conciliation Committee, composed of an equal number of MEPs and Council representatives, tries to reach agreement on a joint text. If unsuccessful, the legislative act will not enter into force and the procedure is ended. If a joint text is agreed, it is forwarded to the European Parliament and Council for a third reading.

Step 7 a: The European Parliament examines the joint text and votes in plenary. It cannot change the wording of the joint text. If it rejects it or fails to act on it, the act is not adopted, and the procedure is ended.

Step 7b: The European Council examines the joint text. It cannot change the wording. If it either rejects or does not act on it, the act will not enter into force and the procedure is ended. If it approves the text and the Parliament also approves it, the act is adopted.

If adopted:

- Regulations are directly binding throughout the EU as of the date set down in the Official Journal.
- Directives lay down end results to be achieved in every member state but leaves it up to national governments to decide how to adapt their laws to achieve these goals. Each directive specifies the date by which the national laws must be adapted.
- Decisions apply in specific cases, involving authorities or individuals and are fully binding.

If not adopted:

If a legislative proposal is rejected at any stage of the procedure, or the Parliament and the Council cannot reach a compromise, the proposal is not adopted, and the procedure is ended. A new procedure can start only with a new proposal from the Commission.

Fit for 55 policy and legislative package

Below is a list of the individual elements to the Fit for 55 package, and a description of their current progress in terms of the EU's Ordinary Legislative Procedure:

1. Energy Efficiency Directive (EED)
2. Renewable Energy Directive (RED II)
3. Carbon Border Adjustment Mechanism (CBAM)
4. Energy Taxation Directive (ETD)
5. Third Energy Package for Gas
6. Regulation on reducing CO2 emissions from vehicles
7. Directive on the deployment of alternative fuels infrastructure
8. Regulation on the trans-European transport network
9. Directive on Energy Performance in Buildings
10. Revision of the regulation on the Inclusion of GHG Emissions and Removals from land use, land use change and forestry (LULUCF)
11. Emission Trading System (EU ETS)
12. European Climate Law
13. Effort Sharing Regulation

Next Steps under the Fit for 55 packages

8. **The European Commission has presented its proposals under the Fit for 55 packages.** The European Council is aligned on the general approach. The package includes the following legislation, provided below with an explanation of the legislative stage each item is at as of December 2022:

Energy Efficiency Directive (EED)[51] [52]

The Council of the EU eventually adopted a general approach on 29 June 2022. This supports the original 40 % RES target proposed by the Commission in July 2021. In terms of the transport sector, the general approach would give Member States the flexibility to choose between a 13 % reduction in GHG intensity *or* a 29 % RES share in the FEC of the transport sector by 2030. The general approach sets less ambitious sectoral targets than the Commission proposal (or the ITRE report), but does support tightening biomass sustainability criteria and accelerating the RES permit granting process.

Trilogue negotiations between the Parliament, the Council and the Commission are ongoing.

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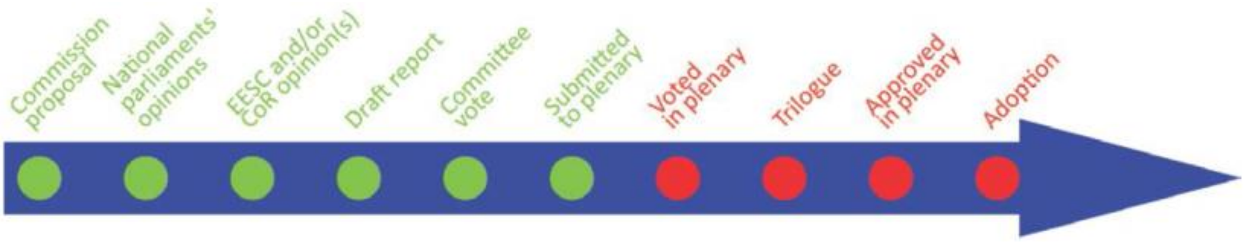
[51] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-renewable-energy-directive

[52] https://epthinktank.eu/2021/09/30/revising-the-energy-efficiency-directive-fit-for-55-package-eu-legislation-in-progress/



Renewable Energy Directive (RED II) [53] [54]

The Council of the EU eventually adopted a general approach on 29 June 2022. This supports the original 40 % RES target proposed by the Commission in July 2021. In terms of the transport sector, the general approach would give Member States the flexibility to choose between a 13 % reduction in GHG intensity *or* a 29 % RES share in the FEC of the transport sector by 2030. The general approach sets less ambitious sectoral targets than the Commission proposal (or the ITRE report), but does support tightening biomass sustainability criteria and accelerating the RES permit granting process.

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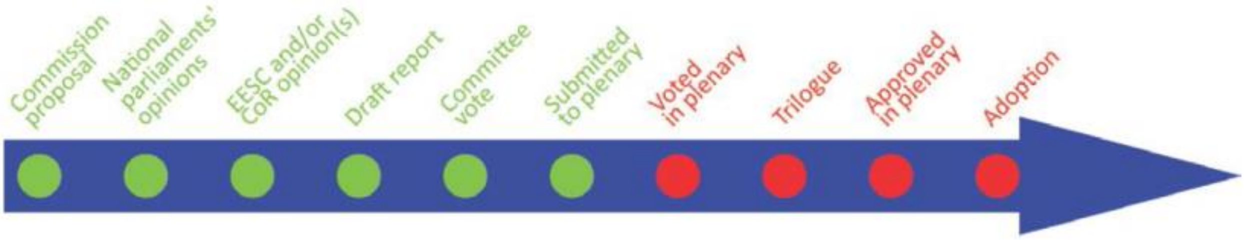

Carbon Border Adjustment Mechanism (CBAM)[55]

The Committee of the Regions adopted an opinion entitled 'Making ETS and CBAM work for EU cities and regions' (rapporteur: Peter Kurz, PES, Germany). It supports the introduction of CBAM as a means to address carbon leakage and to encourage global climate action. The trilogue meetings on the file begun on 11 July 2022, and on 13 December 2022 a provisional political agreement was reached.[56]

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[53] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-renewable-energy-directive

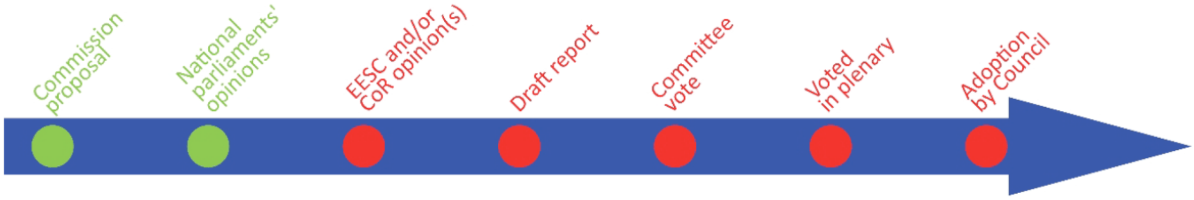
[54] https://epthinktank.eu/2021/11/15/revision-of-the-renewable-energy-directive-fit-for-55-package-eu-legislation-in-progress/

[55] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-carbon-border-adjustment-mechanism?sid=6501

[56] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698889

Energy Taxation Directive (ETD)[57][58]

The European Economic and Social Committee adopted an opinion on the Energy Taxation Directive in plenary on 21 January 2022. The Committee of the Regions adopted its opinion on 27 April 2022.



Third Energy Package for Gas [59] [60]

In the European Parliament, the file has been referred to the Committee on Industry, Research and Energy (ITRE), which appointed Jens Geier (S&D, Germany) as its rapporteur. On 22 March 2022, the ITRE committee organised a hearing on reform of the third gas package followed by a political discussion. The rapporteur produced a draft report in June 2022, which was opened to amendments until July 2022. These amendments are currently in the process of being negotiated. The Committee for Internal Market and Consumer Protection (IMCO) has been associated to this report under Rule 57 of the European Parliament's Rules of Procedure.

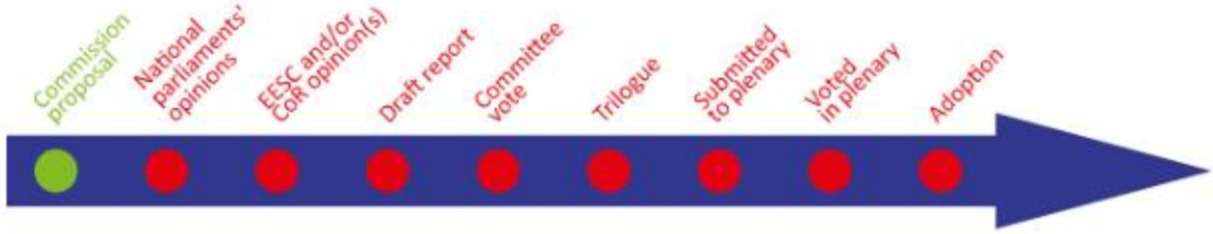
In the Council of the EU, the file has been discussed extensively in the Working Party on Energy and later by COREPER, with a policy debate held during the Council meeting of energy ministers on 25 October 2022.

[57] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-energy-taxation-directive

[58] https://epthinktank.eu/2022/01/20/revision-of-the-energy-taxation-directive-fit-for-55-package-eu-legislation-in-progress/

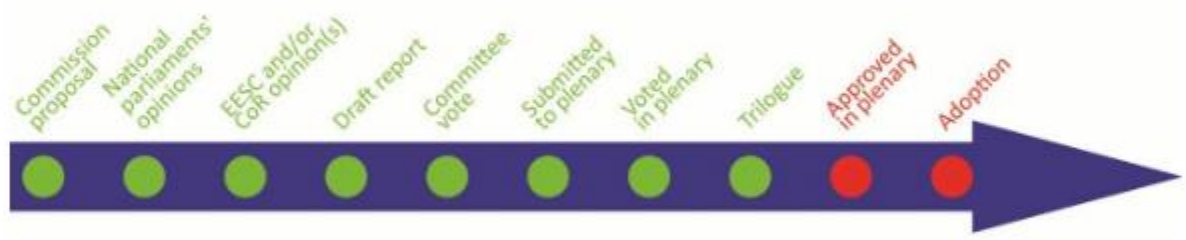
[59] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revised-regulatory-framework-for-competitive-decarbonised-gas-markets-1

[60] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)729303



***Regulation on reducing CO2 emissions from vehicles*[61]**

The agreed text was endorsed by Coreper on 16 November 2022 and by the ENVI committee on 30 November 2022. It needs now to be formally adopted by the Parliament and Council before publication in the Official Journal.[62]



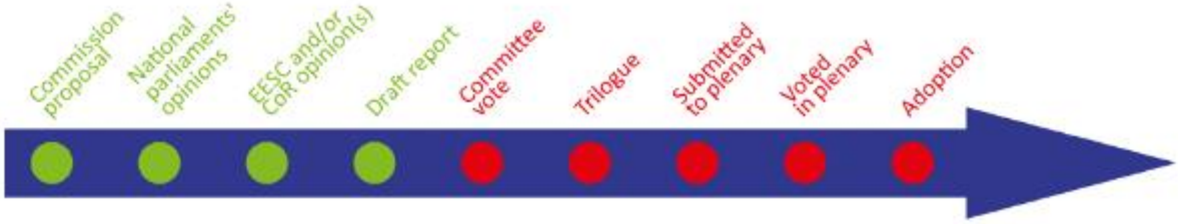
Directive on the deployment of alternative fuels infrastructure [63] [64]

On 2 June 2022, the Council adopted its General Approach, its position for negotiations with the Parliament on the final wording of new rules. On 19 October, the Parliament adopted its position for the interinstitutional negotiations. According to the Parliament, by 2026 there should be at least one electric charging pool for cars every 60 km along TEN-T road network and hydrogen refueling stations along main EU roads every 100 km by 2028.

Parliament's TRAN committee adopted its report on 3 October 2022. The report proposes a number of targets that are more ambitious than the Commission proposal's. For electric charging along the EU's road network, it includes, for instance, higher power output requirements per charging station, and some infrastructure targets to be achieved earlier. For fleet-based targets, the report envisages faster roll-out of infrastructure where electric-vehicle uptake has been low to date. The report was adopted as Parliament's negotiating position on 19 October 2022.

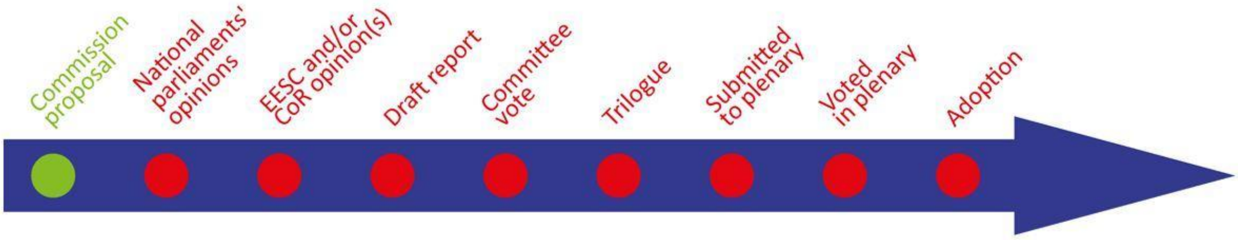
[61] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-co2-emission-standards-for-cars-and-vans-post-euro6vi-emission-standards?sid=6501

[62] https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698920
[63] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-directive-on-deployment-of-alternative-fuels-infrastructure
[64] https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698795/EPRS_BRI(2021)698795_EN.pdf



Regulation on the trans-European transport network [65] [66]

On 6 December 2022, the Council adopted its general approach. The general approach intends to set the following deadlines: for the completion of the TEN-T the core network should be completed by 2030, the newly added extended core network by 2040 and the comprehensive network by 2050. Concerning trains, the text provides for minimum speeds that can be achieved on certain parts of the TEN-T (for instance at least 160 km/h for passenger trains on 75% of the sections connecting urban nodes and 100 km/h for freight trains on at least 90% of these sections).The text sets minimum thresholds for the length of trains that freight terminals should be able to accommodate. In order to harmonize EU rules and in the light of Russia's war on Ukraine, the text provides for the establishment of standard rail track gauge as a norm for the TEN-T and towards Ukraine and Moldova. A section of the text is dedicated to the European Transport Corridors between the EU and Moldova and Ukraine.



Directive on Energy Performance in Buildings [67] [68]

In the European Parliament, the file was allocated to the ITRE committee, which appointed Ciarán Cuffe (Greens/EFA, Ireland) as rapporteur. The rapporteur produced a draft report in June 2022, which was opened to amendments that are being negotiated. The Committee for Transport and Tourism (TRAN) will be associated to this report under Rule 57 (European Parliament Rules of Procedure).

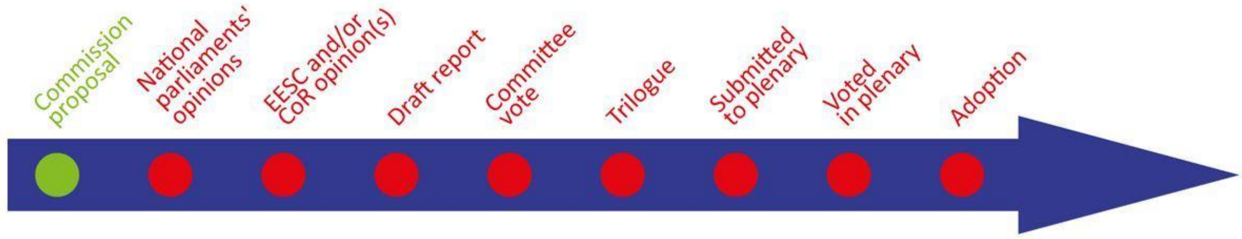
[65] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-ten-t-regulation-review

[66] https://epthinktank.eu/2022/03/17/revision-of-the-trans-european-transport-network-guidelines/

[67] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-energy-performance-of-buildings-directive

[68] https://epthinktank.eu/2022/02/04/revision-of-the-energy-performance-of-buildings-directive-fit-for-55-package-eu-legislation-in-progress/

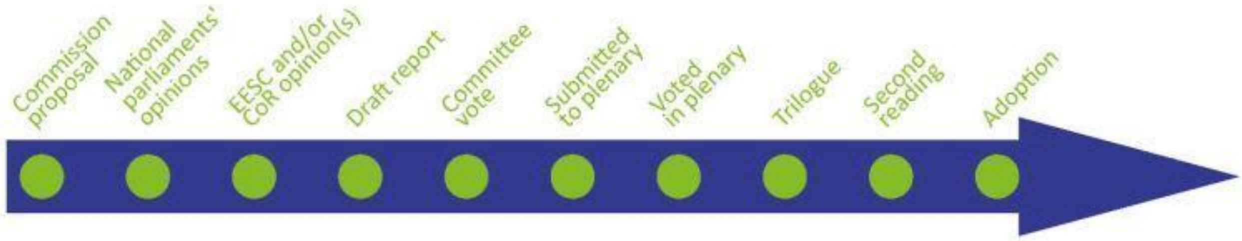
In the Council of the EU, the file has been discussed extensively in the Working Party on Energy and in the Permanent Representatives Committee. The latter adopted a progress report (10 June 2022) that was discussed in the Council of energy ministers on 27 June 2022.



Effort Sharing Regulation [69] [70]

A first trilogue meeting took place on 1 September 2022 to identify the issues on which the institutions' positions diverge, e.g. 2030 target trajectory, level of flexibilities, additional reserve, and post-2030 framework.

A provisional political agreement was reached on 8 November 2022. Parliament and Council negotiators agreed on the approach to defining a linear emissions trajectory ending in 2030 and on the rules on banking, borrowing, and trading emission allocations. The additional reserve would be removed. The final compromise text is expected to be approved by COREPER on 21 December 2022.

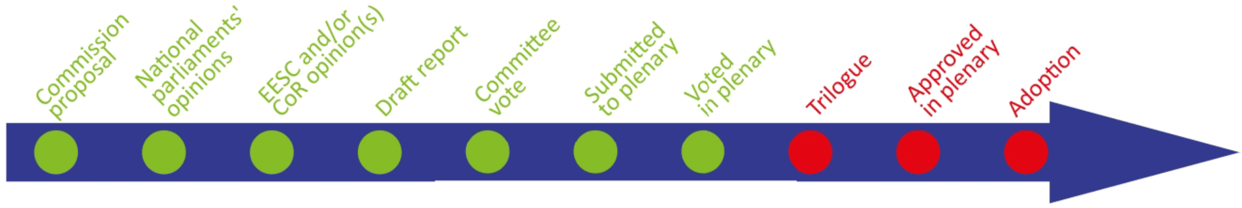


Revision of the regulation on the Inclusion of GHG Emissions and Removals from LULUCF [71] [72]

[69] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-review-of-the-effort-sharing-regulation
[70] https://epthinktank.eu/2017/07/10/effort-sharing-regulation-2021-2030-limiting-member-states-carbon-emissions-eu-legislation-in-progress/
[71] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-lulucf-revision
[72] https://epthinktank.eu/2021/12/13/revision-of-the-lulucf-regulation-strengthening-the-role-of-the-land-use-land-use-change-and-forestry-sector-in-climate-action-eu-legislation-in-progress/

The final text of the provisional agreement is not yet publicly available.

The provisional agreement text is scheduled for vote by COREPER during its meeting on 21 December 2022 and subsequently by the ENVI committee during its meeting of 16 January 2023. The European Parliament will then vote the text in plenary after which it will be published in the official journal of the EU.



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