SHURA
ENERGY TRANSITION CENTER

INDUSTRIAL POLICY ALTERNATIVES FOR TÜRKİYE WITHIN THE FRAMEWORK OF A JUST TRANSITION

About SHURA Energy Transition Center
SHURA Energy Transition Center, founded by the European Climate Foundation (ECF), Agora Energiewende, and Istanbul Policy Center (IPC) at Sabancı University, contributes to the decarbonisation of the energy sector via an innovative energy transition platform. It caters to the need for a sustainable and broadly recognized platform for discussions on technological, economic, and policy aspects of Türkiye's energy sector. SHURA supports the debate on the transition to a low-carbon energy system through energy efficiency and renewable energy by using fact-based analysis and the best available data. Taking into account all relevant perspectives by a multitude of stakeholders, it contributes to an enhanced understanding of the economic potential, technical feasibility, and the relevant policy tools for this transition.

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This report and the assumptions made within the scope of the study have been drafted based on different scenarios and market conditions as of 2022. Since these assumptions, scenarios, and the market conditions are subject to change, it is not warranted that the forecasts in this report will be the same as the actual figures. The institutions and the persons who have contributed to the preparation of this report cannot be held responsible for any commercial gains or losses that may arise from the divergence between the forecasts in the report and the actual values.

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KEY MESSAGES

- Turkish industry's low-technology, low value-added, and carbon-intensive production structure is among the causes underlying macroeconomic imbalances such as the persistent foreign trade deficit and the middle-income trap. Inadequate production in fundamental and strategic sectors increases import dependency while production capacity exceeds domestic consumption in energy and carbon-intensive sectors, stimulating exports and leading to accelerated emissions growth.

- The Green Deal, Carbon Border Adjustment Mechanism, and other discerning procurement policies gaining momentum, particularly within the European Union (EU), are critical factors influencing Turkish industry's international competitiveness. Shortening global supply chains, the EU's Industrial Policy and its overlap with the green transition, and regulations such as the Net-Zero Industry Law stand out as trends to which Türkiye needs to adapt.

- In Türkiye, the need for the transformation of industry and the green transition paradigm strongly overlap. Shifting production from low value-added and energy/carbon-intensive sectors to high value-added and high-tech areas will contribute to sustainable economic development and decarbonisation by reducing energy intensity.

- A transformation that considers the supply-demand structure, strengthens integration into international value chains, and focuses on sectors in which the green transition provides competitive opportunities while supporting primary/strategic sectors will pave the way for added value and technological development.

- In pursuit of economic development and decarbonisation objectives, the "New Inclusive Industrial Paradigm" extends beyond sector-specific growth or solely green/twin transition-oriented policies. It incorporates industry, transportation, finance, and trade policies aligned with sustainable development and growth. The new inclusive strategy is deemed to create a strong potential for both increasing competitiveness and implementing a just transition.

Executive Summary

A. Introduction

Industry, both in developed and developing countries, stands out as a major contributor to global carbon emissions. When we consider the movement of commercial goods, specifically transportation, within the value chain's various dimensions such as supply and distribution, the need to redesign trade, transportation, and financing policies together with industry becomes apparent. This redesign should start with a focus on industrial policy, centring on the axis of a green transition. Energy efficiency practices, electrification, and the development and implementation of renewable technologies as alternatives to fossil fuels in sectors where electrification potential is limited are the essential building blocks of a green industrial policy. However, at the same time, it is crucial to integrate decarbonisation more firmly into the development perspective of the industrial mix at the national level by considering potential improvements that will increase optimization in the movement of raw materials, intermediate goods, and finished products within global value chains (GVC) established over the last 35–40 years. Trends toward shortening of value chains with increased local production need to be taken into account together with their implications at the global scale.

In the Green Industrial Policies formulated or created by developed nations in alignment with the Green Transition or Green New Order paradigm, it is observed that the aforementioned topics are incorporated through varying emphases and priorities.

Based on 2021 data, industry accounted for approximately 35% of Türkiye's primary energy consumption, while transportation accounted for about 25%. When considering that commercial freight transport related to manufacturing constitutes about a 40% share in overall transport, it is estimated that about 45% of total energy consumption stems from industry. When activities such as storage and intermediate transportation within services are added, the total share of industrial production in primary energy consumption is estimated to reach 50%. This share reveals the importance of the structure and development of energy demand in the context of the green transition and the net-zero target and, hence, the importance of industrial strategy design. Türkiye is also a country with significant advantages in combining economic development and the green transition due to the current structure of its industry. Türkiye has an industry mix that leads to high energy consumption and high imports of other raw materials and intermediate goods. In the past 10–15 years, a fundamental structural issue has been extensively debated involving not only high energy consumption but also the necessity to decrease concentration in sectors characterised by low technology and low value added. These sectors also exhibit limited capacity for employment

generation and face uncertainties regarding competitiveness in international trade.

As a shift in Türkiye's industry mix from sectors with high energy intensity but low and medium-low technology to sectors with low energy intensity but medium-high and high technology is essential, the green transition is one of the most critical elements of an industrial strategy to achieve this shift.
In the case of Türkiye, a swift transition in its industrial composition toward medium-high and high-tech sectors is more closely in line with the principles of the green transition paradigm compared to many other countries facing similar circumstances. It seems possible that a new growth paradigm, of which the green transition will be an essential component, will compensate for the economic and social losses, particularly employment losses, that decarbonisation may cause and even enable the creation of new benefits beyond the losses.

B. Overview of Türkiye's Industrial Sector

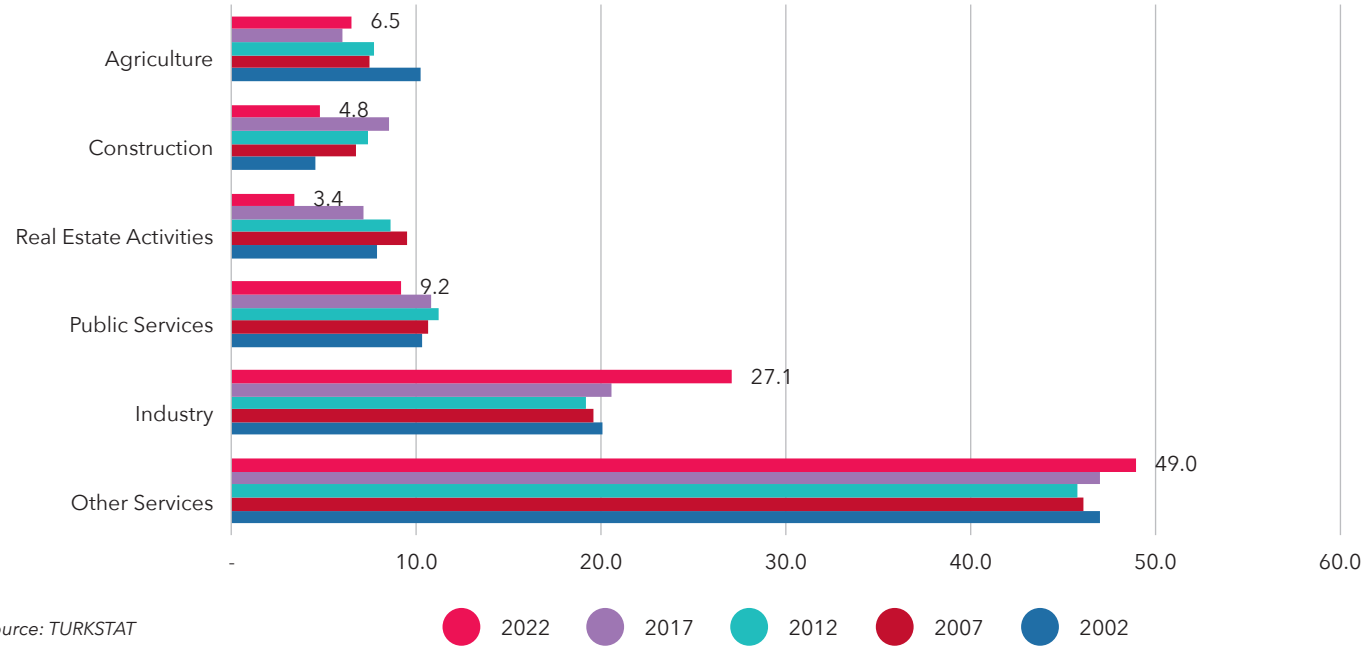
Between 2002 and 2022, the Turkish economy experienced an average annual growth rate of 5.5%. The sources of growth and the contributions of sectors to this growth fluctuated over several sub-periods. Nevertheless, industrial production emerged as the most significant driver of growth, in terms of both its average growth rate and its contributions.

Despite variations in the share of industrial production over time, its contribution to GDP remains essential. While there has been rapid growth in sectors other than the manufacturing industry, such as finance, development and diversification in services, and increases in construction activities, the share of the manufacturing industry in GDP has remained at a certain level. Sectoral diversification and the expansion of production in the manufacturing industry have been decisive in maintaining its share. However, considering that Türkiye is an upper middle-income country, i.e., a country in the upper group of the league of developing countries, its industrial production performance in the last 20 years can be deemed insufficient. Sufficient progress has not been achieved in advancing the manufacturing industry's technological level, reducing imports of intermediate and investment goods, and changing the composition of exports in favour of high-value-added products. These inadequacies have led to the emergence or deepening of structural problems such as foreign trade deficits and high external financing needs. The resulting structure has concurrently led to a high-energy and carbon-intensive manufacturing industry.

While the average share of industrial production in GDP was around 20% between 2002 and 2017, it increased after 2018, reaching 27.1% in 2022,

marking the highest level since 1998. In 2022, the average share of the manufacturing industry in GDP was 22.1%.

Figure ES1. Breakdown of GDP by Sector (%)



Source: TURKSTAT

The notable rise in the share of industrial production in GDP, particularly in 2021 and 2022, is closely associated with cyclical developments, particularly in production in the manufacturing industry[1]. It can be said that some of the dynamics during this period are far from a permanent, maintainable, and structural change in composition. In the long term, looking at the last 20 years, the fact that the share of industrial production in GDP remained stuck at around 20% for a very long time without reaching levels around 30%—unlike the curve historically observed in developed countries—coupled with low value-added production, which the level of technology cannot fully explain, reveals a picture of inefficiency. Nevertheless, notwithstanding the slow progress in the development level of industrial production and the arising structural problems, it should be emphasized once again that Türkiye has one of the most advanced industrial production structures among comparable countries.

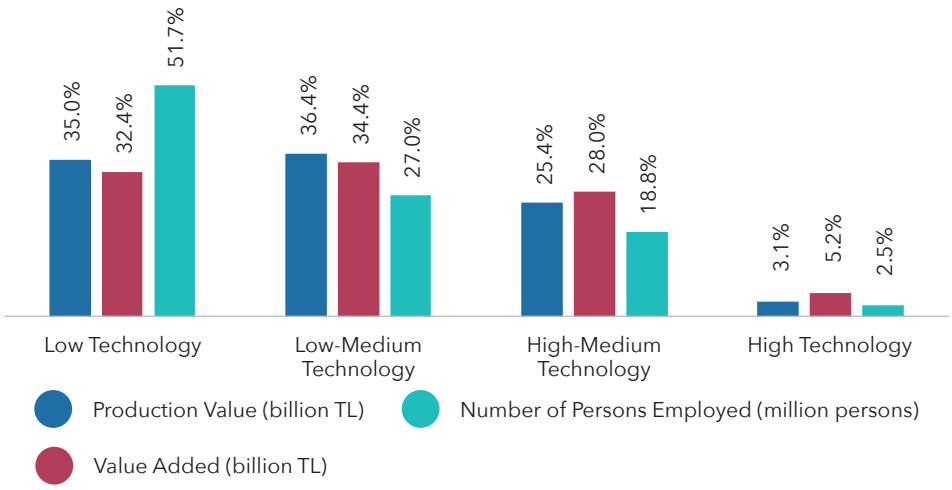
Among the three primary activity groups classified under industrial production—namely the manufacturing industry, mining, and energy—the manufacturing industry is the most pronounced due to its sectoral diversity and level of development. The manufacturing industry constitutes

[1] Industrial production consists of three main subcomponents: Manufacturing, mining, and energy.

approximately 86% of the industrial production value[2], 86% of the value added at factor costs[3], and employs about 95% of the industrial workforce. The ratio of the industrial production value- added to industrial production value (i.e., value-added ratio) averaged 20.5% in the 2009–2021 period. In the same period, the mining sector had the highest ratio, averaging 41%. This is followed by the manufacturing industry, with an average of 20.5%, while the value-added ratio in the energy sector is lower, at 16.8%. Based on reasons such as the high share of low and medium-low-technology sectors in the valued-added manufacturing industry, the elevated share of imported raw materials and intermediate goods in medium-high- and high-technology sectors, the generally insufficient role of R&D and innovation-based growth, and the structure of trade, the current level of the value-added ratio is deemed to be "lower than it should be."

In the Turkish manufacturing industry, there is a relatively high share of production in low- and medium-low-technology sectors, whereas the contribution from high-technology sectors is limited. An analysis of manufacturing activity by technology level reveals that 71.4% of the production value, 68.8% of the value added, and 78.7% of the employment in 2021 originated from low- and medium-low-technology sectors. The imbalance in the composition of the technology in the manufacturing industry, manifested as the excessively high share of low-technology and very low share of high-technology sectors, points to one of the most important structural problems of the manufacturing industry.

Figure ES2. Breakdown of Manufacturing Industry Production Value, Value Added and Employment by Technology Level (2021)



Source: TURKSTAT Annual Industry and Service Statistics

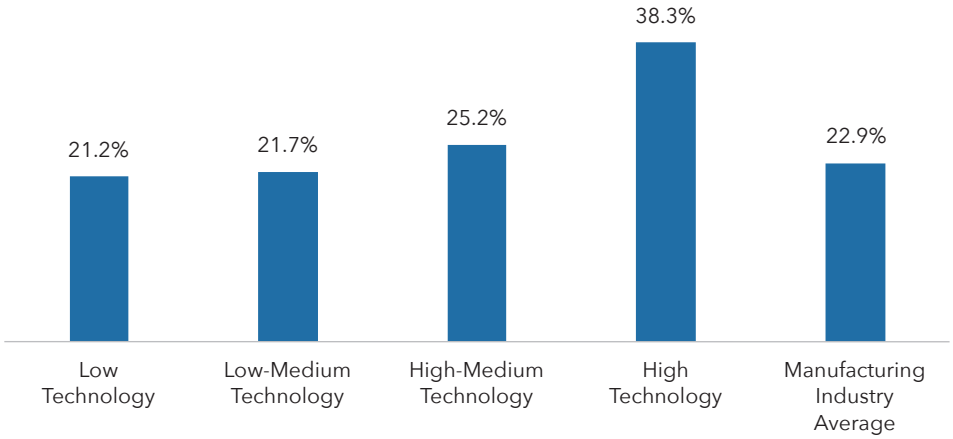
[2] **Industrial production consists of three main subcomponents:** Manufacturing, mining, and energy (TURKSTAT).
[3] **Value added at factor cost:** Gross income from business activities after adjustments for business subsidies and indirect taxes. (TURKSTAT)

The continued expansion of production capacity in low- and medium-low-technology sectors, stimulated more strongly by external demand, has been one of the factors suppressing value-added growth in medium-high-technology sectors, which could have served as an essential lever. The fact that product composition did not evolve to meet the demand for intermediate goods from domestic higher-technology sectors—e.g., that despite the growth in long iron and steel products both the capacity and spectrum of flat products remained relatively constant, reinforcing the input import dependency of medium-high-technology sectors and suppressing their value added. The same assessment can be made for the chemicals sector by comparing the development of basic chemicals with the development of processed plastic products, particularly packaging. Likewise, the distribution of both equity and external financing resources across sectors can be analysed in this context. The "inefficiency" pointed out above is intended to reflect the current structure of the manufacturing industry on the whole rather than low efficiency on an individual sector, sub-sector, or firm basis. Factors such as backward and forward linkages, inter-sectoral interaction, and resource preferences explain this inefficiency more strongly.

According to 2021 data, the ten sectors with the highest share of production in the manufacturing industry are basic metals, food, textiles, motor vehicles, fabricated metal products, chemicals, electrical equipment, rubber and plastics, machinery, and apparel. The share of "other non-metallic minerals (glass, ceramics, cement)", which was in the top ten in previous years, declined as domestic demand fell due to contraction in the construction sector. The increase in the share of the basic metals sector in 2021 and the contraction of the share of the automotive sector are cyclical. In the long run, with the disappearance of temporary effects, the basic metals industry is expected to rank in second place after food, as in previous years. In contrast, the automotive industry is expected to rise to third place.

The main structural problem in manufacturing industry production is not only the high share of sectors with low levels of technology but also that the share of value added in the production value for each level of technology remains below what it should be. Despite significant development, especially in medium-high-technology sectors, progress in the value-added ratio has been slow. The share of value added in the production value of low- and medium-low-technology sectors are very similar (21.2% and 21.7%, respectively), and the difference between the value-added ratio of medium-high-technology sectors (25.2%) and low-technology groups is insufficient.

Figure ES3. Value Added Factor Cost/Production Value



Source: TURKSTAT Annual Industry and Service Statistics

An evaluation of the value-added ratio of manufacturing industry sectors from a long-term development perspective rather than focusing on the cyclical developments in recent years reveals that textile, chemical, and high-technology sectors recorded a striking increase. The rise in the value-added ratio of these sectors was driven by increases in domestic production capacity (e.g., petrochemical investments) and high value-added products (e.g., technical textiles and hygienic fabrics in textiles, diversification of product composition in high-tech sectors) as well as import substitution (e.g., increase and diversification in yarn and fabric production in textiles due to protectionist regulations).

C. Assessment of Selected Focal Sectors Within the Context of the Green Transition

General View

The selected sectors are categorized along two axes: the first axis encompasses sectors under Phase 1 of the Carbon Border Adjustment Mechanism (CBAM), while the second axis comprises sectors with a higher share of international trade, particularly with the EU, and holding a significant share of trade within the manufacturing industry.

- **Carbon Border Adjustment Mechanism Phase 1 Sectors:** In this scope, basic metals and fabricated metal products, including iron and steel products; basic metals, including aluminium; other non-metallic minerals, including cement; and chemicals, including fertilizers and hydrogen, are evaluated.
- **Sectors with High Foreign Trade Volumes and High Shares in the Manufacturing Industry:** Sectors with higher shares in both manufacturing

industry production and Türkiye's exports that need to be addressed in the context of the Green Transition are motor vehicles, textiles, apparel, electrical equipment, and machinery.

A comparison of the change in the first group of selected sectors, i.e., the **CBAM sectors,** with the manufacturing industry average shows that all sectors other than cement-glass-ceramics ("other non-metallic minerals") exhibited a high increase in total production value and value added in the 2009–2021 period compared to the manufacturing industry average. Again, with the exception of non-metallic minerals, all CBAM sectors have higher increases in value added per employee compared to the manufacturing industry average. In the cement-glass-ceramics sector, the contraction in domestic demand stemming from the slowdown in construction sector growth since 2018 has limited growth on a cyclical basis. Therefore, growth performance above the manufacturing industry average for all CBAM sectors, including cement-glass-ceramics, is associated with strong domestic demand as well as high external demand. In sectors that use products from CBAM sectors as inputs, particularly automotive and electrical equipment, exports constitute over 70% of production.

While the average value-added/production ratio of the CBAM sectors surpasses the manufacturing industry average, this ratio remains comparatively low, especially in view of factors such the capital-intensive nature of a substantial portion of these sectors and the international averages within the same industry segments. Although the structure of production capacity (product structure), demand structure, level of integration into global value chains, import dependency in energy and inputs, technology dependency, access to finance, etc., are different for each sector, there are significant areas for improvement for each sector. As emphasized earlier, changes in the production capacity structure in basic metals will not only increase the value added in the sector but also directly contribute to industries such as fabricated metal products, motor vehicles, electrical equipment, and machinery.

The low level of value added in the basic metals industry can be attributed to the product composition and technology employed in the iron and steel sector, which has a significant share in this industry. Approximately 65% of iron and steel production involves the processing of predominantly imported scrap iron into long products through electric arc furnaces, resulting in relatively low value added. Since this production process produces low-unit-value products with high imported input costs, the value-added ratio of the products is low. On the one hand, the sector with the highest value-added ratio within the group is other non-metallic minerals (glass-ceramics-cement), which have the lowest total production value and value-added growth. Since

all products in this sector are processed from domestically available stone, soil, and minerals with low costs compared to the final product, their value-added ratio is high. On the other hand, in the chemical industry, which, like the basic metals industry, has a very high share of imported inputs, the value-added ratio is still high compared to the manufacturing industry average, as the value of the final products is higher compared to the costs.

The noticeable rise in the value-added ratio across all sectors within this group and the broader manufacturing industry over the last five years is remarkable. This predominantly cyclical surge was primarily propelled by increases in exchange rates and raw material prices, particularly in energy-intensive sectors like basic metals, cement-glass ceramics, and chemicals. These factors were reflected in final product prices, along with the implementation of temporary subsidized energy tariffs during that period. In product categories related to the construction sector, the significant depreciation of the Turkish Lira, coupled with a contracting domestic market, played a crucial role in creating export opportunities and generating revenues.

Table ES1. Main Indicators of the Selected Focal Sectors

	Change in Production Value	Change in Value Added	Change in Employment	Change in Value added per Employee	Value Added/ Production Value	Value Added/ Production Value
	(2021/2009)	(2021/2009)	(2021/2009)	(2021/2009)	(Average 2009-2021)	(Average 2017-2021)
Manufacturing Industry	91.5%	123.0%	77.1%	26.0%	19.8%	22.0%
Basic Metals	161.0%	404.0%	68.0%	201.0%	15.0%	17.6%
Fabricated Metal Products	135.0%	142.0%	76.0%	37.0%	23.8%	24.6%
Other Non-Metallic Minerals	40.0%	52.0%	58.0%	4.0%	26.9%	27.6%
Chemicals	145.0%	250.0%	79.0%	84.0%	22.9%	26.2%
Motor Vehicles for Land Transport	98.0%	131.0%	58.0%	46.0%	18.8%	19.4%
Textiles	98.0%	144.0%	68.0%	45.0%	23.7%	25.6%
Apparel	37.9%	58.4%	83.0%	7.0%	21.9%	22.9%
Electrical Appliances	85.0%	87.0%	98.0%	6.0%	21.1%	22.1%
Machinery	152.0%	140.0%	103.0%	6.0%	24.6%	27.4%

Source: TURKSTAT Annual Industry and Service Statistics

In the second group of sectors, characterized by substantial foreign trade activity and a significant presence in the manufacturing industry, the growth in production and value added during the period from 2009 to 2021 exceeded the manufacturing industry average but fell short compared to the first group of CBAM sectors. Notably, the increase in value added within these sectors was lower than the growth in production value, contrasting with the trends observed in the CBAM sectors.

The value-added ratio within the second group remains higher than the manufacturing industry average but falls short compared to the average of the CBAM sectors, despite operating predominantly at a higher technology level, specifically in medium-high-technology sectors. In this group, the machinery sector stands out as the sector that has increased its value-added ratio along with total production value and value added the most, due to its predominant use of domestic inputs and the recent increase in innovative and more specialized products. The textile sector has maintained a consistently high value-added ratio, particularly in the last five years, owing to the growing reliance on domestic inputs and increase in specialty products. Conversely, the automotive industry, a key export sector, exhibits a modest value-added ratio. This is attributed to factors such as substantial reliance on imported inputs, particularly in motor vehicles, license fees paid to international manufacturers, and the concentration of production in low-segment vehicles, all contributing to the decreased value-added ratio in the automotive sector. In electrical equipment, especially in household electrical appliances, in which Türkiye has a significant market share, the high share of imported inputs, low demand growth, and concentration in mid-segment products limit the value-added ratio. However, it should be noted that the strong effects of rapid and early adaptation to the electric vehicle ecosystem in motor vehicles and the strong effects of developing production capacity for renewable energy equipment and new energy technologies (storage, etc.) can compensate for the current weaknesses in electrical equipment. In apparel, despite the low-tech nature of the sector, above-average value added is achieved thanks to the high share of domestic inputs and product value, as well as the relatively low unit labour costs in this labour-intensive sector.

When assessing the selected focal sectors in the context of decarbonisation, it becomes evident that CBAM sectors are characterized by high-energy consumption and carbon intensity. Some involve production processes not prone to direct electrification due to high heat demand. Adding to the impact of emissions from the transportation of bulky products, sectors such as basic metals, non-metallic minerals, and basic chemicals are generally considered “hard to decarbonise.” The share of fertilizers (which are among energy-intensive chemical products), non-metallic minerals, and basic metals, in Türkiye’s total energy consumption is 19% while their share in

industrial energy consumption is 62%. The share of fossil fuels in total energy consumption in these sectors is around 75%, which is high compared to the industrial sector average of 60%. In the textile sector, which has a 3% share in total energy consumption, despite some energy-intensive sub-sectors, only 54% of energy consumed is fossil fuels, thanks to the tendency toward electrification. In the second group of sectors, such as motor vehicles, electrical equipment, and apparel, energy and carbon intensity are low compared to value added.

Growth Dynamics

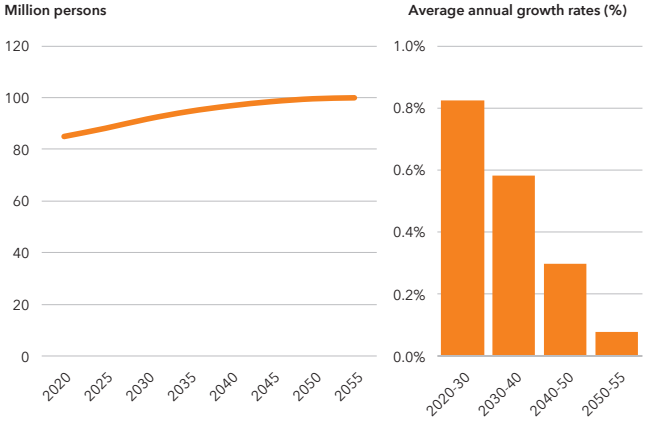
The growth potential of the selected focal sectors has been evaluated from two perspectives: first, on the decarbonisation and green transition axis, and second, from assessing the internal dynamics of the sectors, market potentials, and their strategic positions concerning economic development. The economic growth assumptions in SHURA's "Net Zero 2053: Roadmap for Türkiye's Electricity Sector" study, which are integrated with population growth and sectoral dynamics, form the basis of this assessment. These assumptions are shown below:

Figure ES4. General Assumptions in SHURA's Net Zero Carbon Pathway

By 2053. Türkiye's population is projected to reach 100 million people while annual average GDP growth is estimated to be 3.3%.

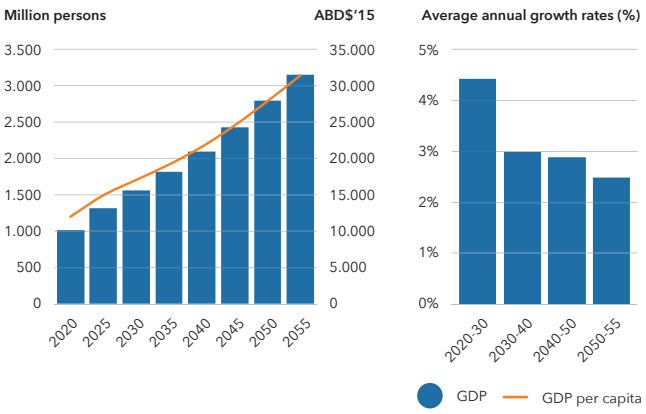
Demography

Period	Average Gtowth Rate (%)	End-year Population (million persons)
2020-30	0.83%	91.6
2030-40	0.58%	97.0
2040-50	0.30%	99.8
2050-60	0.02%	100.1



Gross Domestic Product (GDP)

Period	Average Gtowth Rate (%)	End-Year GDP (billion US$ 2015)	GDP per capita (US$ 2015 per capita)
2020-30	4.4%	1.561	17.042
2030-40	3.0%	2.096	21.595
2040-50	2.9%	2.787	27.878
2050-60	2.4%	3.525	35.176



Source: SHURA 2023 ("Net Zero 2053: Roadmap for the Turkish Electricity Sector")

With regard to the above assumptions, the development potential for growth in the selected focal sectors in comparison to the manufacturing industry average is assessed. It is anticipated that the growth in CBAM sectors, including iron and steel, other non-metallic minerals (cement-glass-ceramics), and chemicals—sectors characterized by high energy and carbon intensity and posing challenges in terms of decarbonisation—will be slower than the average growth in the manufacturing industry. On the other hand, fabricated metal products have above-average growth potential in line with their relatively low energy-intensive production processes and the demand from high growth sectors, such as construction, automotive, and machinery. Growth in energy- and carbon-intensive CBAM sectors is projected to be driven mainly by domestic demand rather than exports given their dependence on imported inputs and energy. In these sectors, especially in chemicals, iron, and steel, shifting towards high-value-added products predominantly oriented towards domestic demand through import substitution is an essential strategy for sustaining income and reducing the carbon intensity of production. It can also be said that Türkiye's export level in recent years in CBAM Stage 1 product groups, such as long iron and steel products and cement, is unsustainable due to such factors as the structure of international trade and competitiveness. In selected focal sectors outside the CBAM, textiles and apparel are expected to grow in line with the manufacturing industry average, while automotive, electrical equipment, and machinery are expected to rise above the manufacturing industry average, especially in the period before 2030. With relatively low energy intensity and high electrification potential, these sectors have the potential for both domestic and export-led growth.

When the central dynamics driving the domestic and international demand for each sector are evaluated, the main drivers for the domestic market are population, GDP, construction, the manufacturing industry, and electric vehicles/renewable energy equipment growth and policies for import substitution, although the impact varies from sector to sector. In contrast, for exports, the green transition/circular economy, investments in developed and emerging markets, sustainable products, and technological developments stand out as the main drivers, especially in the EU market.

Within the CBAM sectors, the primary catalysts for domestic demand, particularly in the iron-steel and glass-ceramic-cement groups, are GDP growth, population growth, and the expansion of the construction sector. Conversely, the overall growth in the manufacturing industry will impact the growth of fabricated metal products and both basic and specialty chemicals. At the same time, iron-steel and manufactured metal products will also be boosted by demand from medium-high-technology sectors such as automotive, machinery, electrical equipment, emerging electric vehicles, and renewable energy equipment. In these sectors, it will be essential to adapt

the product composition to the demand-driving sectors as in increasing the share of flat and specialty products in iron and steel. In this group, import substitution policies can provide a driving force for transforming the iron-steel and chemicals sectors. On the other hand, in the CBAM sectors, especially in areas such as chemicals, building materials, and fast-moving consumer goods, emerging sustainable product alternatives limit the growth of traditional products. New products such as green steel, low-clinker cement, and chemicals made from recycled and biological materials will become the new engines of growth in these areas. Nevertheless, overall growth rates, in general, will slow down compared to past rates.

In the selected focal sectors outside of CBAM, factors such as population growth, GDP per capita growth, and urbanization will play a significant role in industries targeting final consumers, such as automotive, electrical equipment, and apparel. Concurrently, the growth in buildings and residential construction (e.g., home textiles and white goods), overall manufacturing industry growth (machinery, technical textiles), and the demand for electric vehicles and energy transition equipment (motor vehicles, machinery) will be key drivers of growth in textiles, machinery, and certain electrical equipment products, particularly those categorized as intermediate or investment goods. In the motor vehicles and machinery sectors, import substitution policies, especially tax and public procurement policies, will effectively grow domestic demand. The development in sustainable products in this sector group is expected to trigger an increase in demand for electrical equipment used as investment goods. In contrast, the rise in demand for sustainable textiles and ready-to-wear clothing products is expected to reduce the demand for traditional products and slow overall growth.

In energy- and carbon-intensive sectors such as iron and steel, non-metallic minerals, and chemicals, where the importance of exports relative to domestic demand is expected to decline, the central growth dynamic in exports is expected to be driven by the development of products that are compatible with the green transition and the circular economy. Investments in developing countries to create new production capacity are expected to trigger exports in products such as iron, steel, and glass, while in cement and ceramics, these investments are expected to have a slowing effect on exports as they will mean the emergence of competing capacities. The shortening of supply chains, which has become an essential trend in target markets, especially in the EU, will not significantly impact these products, which have high export costs compared to their value. On the other hand, fabricated metal products, which include value-added and diverse products, are expected to benefit from shorter supply chains. Moreover, the emerging electric vehicle ecosystem and energy transition technologies will also create export opportunities for fabricated metal products. In sectors other than the CBAM

sectors, the green transition, the circular economy, and the green deal are expected to be generally growth-enhancing, especially in the EU market. The potential for increased exports in these highly EU-integrated sectors will be enhanced by shorter value chains. Anticipated expansions in investments in emerging markets are also poised to stimulate export growth in the apparel, machinery, and electrical equipment sectors.

D. Manufacturing Industry Transformation Needs and Development Projections

The imperative for transformation in the manufacturing industry arises from the need for structural changes in the national economy that align with the goals of decarbonisation. The composition of production in the manufacturing industry—characterized by low value added, low technology, and high energy and carbon intensity, coupled with insufficient production capacity for meeting domestic demand in fundamental and strategic products—has led to import dependency and trade deficits. Exports stimulated by production capacity exceeding domestic demand in energy-intensive products also exacerbate these problems. Therefore, along with energy efficiency practices and policies to increase access to clean energy, a shift towards medium-high and high-technology sectors in the manufacturing industry as a whole and concentrating on high value-added products within traditional sectors/sub-sectors will contribute to both slowing down growth in total energy demand and reducing the foreign trade deficit. In this context, transformation requires reducing the share of sectors with high energy intensity, low-technology levels, and low value added in production and increasing the share of medium-high- and high-technology sectors with low energy intensity. As the previous section shows, domestic demand and foreign market trends/opportunities allow for a transformation along this axis.

In light of the assessments and forecasts provided above, the outlook for the manufacturing industry, assuming a comprehensive structural transformation with technological advancements and adherence to the principles of the green transition, is summarized in Table ES 2. Through a three-pronged transformation involving a shift from low-technology to higher-technology sectors, transitioning from energy-intensive to low energy-intensive industries, and aligning the supply-demand structure according to the dynamics of each sector, the share of medium-high and high-technology sectors in the manufacturing industry is projected to increase from 29% in 2021 to 36% in 2030 and further to 44% in 2040. Consequently, the value-added/production value ratio for the manufacturing industry as a whole is anticipated to rise from 23% in 2021 to 27% in 2030 and surpass 30% in 2040. These developments are expected to lead to a 78% increase in the value added per employee, from USD 27,000 in 2021 to USD 48,000 by 2040.

Table ES2. Development Projections in Selected Focal Sectors by Technology Level

	Share in the Manufacturing Industry			Value Added/Production Value			Value Added Per Employee (thousand US$)		
	2021	**2030**	**2040**	**2021**	**2030**	**2040**	**2021**	**2030**	**2040**
Low Technology	**33.5%**	**35.0%**	**30.5%**	**21.2%**	**24.2%**	**26.3%**	**16.8**	**22.5**	**25.6**
Textiles	8.5%	8.4%	7.2%	26.6%	30.0%	32.0%	24.0	31.6	35.3
Apparel	5.0%	5.8%	5.2%	22.4%	27.5%	27.5%	8.7	12.3	15.4
Low-Medium Technology	**36.8%**	**28.9%**	**25.6%**	**21.7%**	**25.5%**	**28.8%**	**34.0**	**40.3**	**45.8**
Other Non-Metallic Minerals	4.2%	4.4%	3.9%	28.9%	32.5%	35.0%	24.5	35.9	33.3
Basic Metals	14.0%	8.5%	7.1%	21.0%	22.5%	25.0%	93.6	132.1	156.4
Fabricated Metal Products	6.6%	6.4%	6.5%	24.3%	30.0%	35.0%	20.6	27.6	36.6
High-Medium Technology	**26.6%**	**30.7%**	**36.3%**	**25.2%**	**28.9%**	**33.8%**	**39.9**	**59.6**	**85.5**
Chemicals	6.0%	6.4%	6.7%	27.6%	30.0%	35.0%	81.0	121.2	168.9
Electrical Appliances	5.4%	5.7%	6.0%	22.7%	27.5%	32.5%	32.3	48.8	68.7
Machinery	5.2%	7.1%	9.5%	26.0%	32.5%	37.5%	25.7	44.5	71.0
Motor Vehicles for Land Transport	7.8%	9.0%	9.7%	22.3%	25.0%	30.0%	45.0	71.6	103.6
High Technology	**3.1%**	**5.3%**	**7.6%**	**38.3%**	**38.2%**	**40.2%**	**54.8**	**122.4**	**183.0**
Total or Manufacturing Industry Average	**100.0%**	**100.0%**	**100.0%**	**22.9%**	**26.7%**	**30.7%**	**26.8**	**36.8**	**47.6**

Source: Authors estimates and calculations; SHURA 2023 ("Net Zero 2053: Roadmap for the Turkish Electricity Sector")

The above projections are based on assumptions derived from assessing the sectors' current situation and growth dynamics. In low- and medium-low-technology sectors, domestic demand growth is assumed to slow down compared to past periods due to the already high penetration level of these products, especially in consumer goods. In low- and medium-low-technology sectors, export growth is also expected to decelerate in products with high energy intensity and high unit transportation costs (e.g., long products in iron and steel, products based on stone and soil such as cement, etc.). On the other hand, in basic and strategic sectors with high imports (e.g., flat products in iron and steel, basic chemicals, etc.), whose production is insufficient to meet domestic consumption, structural and green transition requirements are consistent with capacity formation and production growth along the lines of import substitution. In medium-high- and high-technology sectors, in addition to domestic demand, there is high demand potential from foreign markets; therefore, export growth is expected to catch up with, and in some cases exceed, past averages. The green transition, especially the diffusion of clean energy technologies and the electrification of heating and transportation, will trigger domestic and foreign demand and increase the share of these sectors in the manufacturing industry.

E. Policy Options and Recommendations for Policy and Action Areas

To fulfil the projections outlined in Table ES 5, Türkiye needs a comprehensive industrial policy design in line with the transformation required in the manufacturing industry. This design should prioritize specific sector strategies and policies to address the unique dynamics and requirements of each sector. The projections by industry mix provided above, which can be considered cautious and achievable within a well-developed policy framework, assume simultaneous development of the following areas:

- Increasing the share of high-technology sectors within the manufacturing industry; prioritizing the improvement of the competitiveness of medium-high- and high-technology sectors in trade policy and strengthening their integration into international value chains; developing policies and regulations for the transformation of basic sectors (chemicals, basic metals, etc.) to increase total value added.
- Supporting the development of high-technology and/or high value-added sub-sectors, reducing energy intensity, developing sustainable materials, and effectively implementing the circular economy, in trade policy, supporting competitive products/product groups by taking into account explicit and implicit subsidies/costs.
- Ensuring a supply-demand structure that is oriented towards augmenting total value added and benefits in both the manufacturing industry and the broader economy.
- Taking into account the new Green New Deal-oriented growth paradigms of developed countries, particularly the European Union and Türkiye's other major trading partners, and taking advantage of new opportunities in terms of investment, financing, and trade while minimizing risks.
- Developing policies by addressing the impacts of the CBAM on manufacturing industry sectors within the scope of long-term transformation needs while rapid action is still required in the short to medium term; ensuring that regulations for decarbonisation, particularly the Emissions Trading System, include medium- to long-term transformation perspectives rather than short-term commercial interests.

Policy Options

The industrial strategy/policy design options that match the transformation needed in the manufacturing industry at different levels are summarized in Table ES 3.

Table ES3. Industrial Policy Strategy Options

Option 1: New Inclusive Industrial Paradigm	Option 2: Green Industrial Policy	Option 3: Twin Transformation (Green and Digital) Strategy	Option 4: Growth Oriented Industrial Strategy
A holistic and inclusive approach focusing on the entire economy	An approach focused on decarbonising industry with a view to climate-neutrality	Joint digital transformation and green transition in industry	Perspectives for the growth of each sector/subsector with its current structure
A set of industrial, trade, transportation, and finance policies in line with the Sustainable Development/ Growth perspective	A set of policies for the industrial ecosystem	A set of policies for the industrial ecosystem	Collection of policies for specific sectors
Industrial Transformation: Strengthening high value-added production through technological investments, primarily by eliminating asymmetries in critical sectors and decarbonising production	Industrial Transformation: Decarbonisation of sectors with their current structures, taking advantage of the opportunities presented by the green transition process	Industrial Transformation: Raising the technological level of industrial production and decarbonising production	Industrial Transformation: Decarbonisation from a trade perspective (CBAM, etc.) and technological targets from the perspective of specific sectors
Creating high quality employment opportunities	Creating green employment opportunities	Digital and green employment opportunities	Limited employment opportunities
Increasing global competitiveness: Strong	Increasing global competitiveness: Medium	Increasing global competitiveness: Medium	Increasing global competitiveness: Limited
Just transition perspective: Strong	Just transition perspective: Medium	Just transition perspective: Medium	Just transition perspective: Inadequate

Modelling results of SHURA's net-zero carbon roadmap reveal that achieving the net-zero target means going beyond a transition to zero-carbon energy source and toward halting the increase in total energy consumption. The analyses presented in this study show that unless the current structure of industry changes, Türkiye's chances to achieve both the value-added increase needed to overcome the structural problems of the economy and the pace of improvement toward net-zero targets will remain insufficient. In this context, strategies that include interventions in the green transition or twin transition that preserve the current structures of the sectors will not be sufficient to ensure a just transition and improve international competitiveness and may create problems in terms of optimizing financial resources. Therefore, the first option, the New Inclusive Industrial Paradigm is recommended as this design closely matches the needs of the transformation.

Recommendations for Policy and Action Areas

The "New Inclusive Industrial Policy" outlines a holistic and multi-dimensional structure. In this context, the strategy must include the following features:

- An economy-wide orientation and inclusiveness;
- A set of industrial, trade, transportation, and financial policies in line with the Sustainable Development/Growth perspective;
- Industrial Transformation: Strengthening high value-added production

and decarbonisation of production through technological investments, particularly by eliminating asymmetries in key sectors;
- Creating qualified employment opportunities;
- Increasing global competitiveness;
- Just transition perspective.

The general policy and action area proposals developed in this direction are given below:

Policy Area 1: Industrial Targets from a Sustainable Development Perspective

Viewed through the lens of the UN Sustainable Development Goals, including the green transition as an integral component, it is necessary to establish an industrial framework that aligns with medium- to long-term development objectives like the 2030 Agenda and the 2053 net-zero target. The proposed industrial framework is based on the following primary axes:

- Analysing the areas where production capacity needs to be improved in key sectors with a view toward resolving supply-demand mismatches and their impacts on industry and the economy.
- Prioritizing decarbonisation from the perspective of industrial transformation.
- Identifying sectors/sub-sectors with high value-added and high market potential.

Policy Area 2: Priority Sectors for Industrial Transformation

In alignment with the targeted industrial design, it is imperative to pinpoint priority sectors such as those with strong impacts on sectors with forward linkages, those holding high potential for enhanced integration into international value chains, and those playing a pivotal role in the context of the green transition. This approach emphasizes broader strategic directions rather than specific improvements to individual industries.

Basic sectors: Iron and steel, chemicals, energy.

Sectors with High Potential in International Value Chains: Automotive and Parts Industry, Electrical Equipment, Machinery, Aircraft, Other Transportation Vehicles, Renewable Energy/Energy Transition Equipment, and Advanced Materials.

Green Transition Potential: Building Materials, Fabricated Metal Products, Plastics and Rubber.

Policy Area 3: Trade Policy Priorities

Türkiye's main efforts to develop a comprehensive and holistic trade policy framework took place as part of the EU/Customs Union process, particularly during the ten years from the mid-1990s to the mid-2000s, after which it was not able to develop a comparable new framework. The transformation of national economies particularly following the 2008 global financial crisis and the repercussions of the COVID-19 pandemic as well as the Russia-Ukraine War has accentuated trends like the adoption of proximity-driven supply policies and the reinforcement of regional value chains. In this context, Türkiye has room to manoeuvre to develop trade policy preferences based on comprehensive international value chain analyses and economic and social cost analyses in line with its target industrial design.

Policy Area 4: Further Integration into International Value Chains

There is a need to enhance integration into international value chains, fortify industrial ecosystems with substantial potential for value-added growth, and formulate policies and initiatives geared towards bolstering competitiveness, particularly in medium-high technology sectors. Apart from augmenting the production capacity of fundamental sectors, it is crucial to advance research and development (R&D) and design capabilities as well as implement measures to elevate value added by improving costs and prices within the current production structure.

Policy Area 5: Financing Investments

Emphasis should be placed on expanding access to financing sources in accordance with investment requirements, moving away from investments dictated by the availability of financing. The imperative to build resilient cities and enhance infrastructure, coupled with the necessity for a comprehensive industrial transformation, widens Türkiye's flexibility in this domain.

Policy Area 6: Creating Decent Employment Opportunities

It is necessary to activate the potential of both emerging sectors and the traditional ones expected to exhibit robust growth for generating new and decent employment opportunities in response to possible negative impacts of multidimensional transformation processes, such as decarbonisation and technological advancement.

About Istanbul Policy Center at the Sabancı University

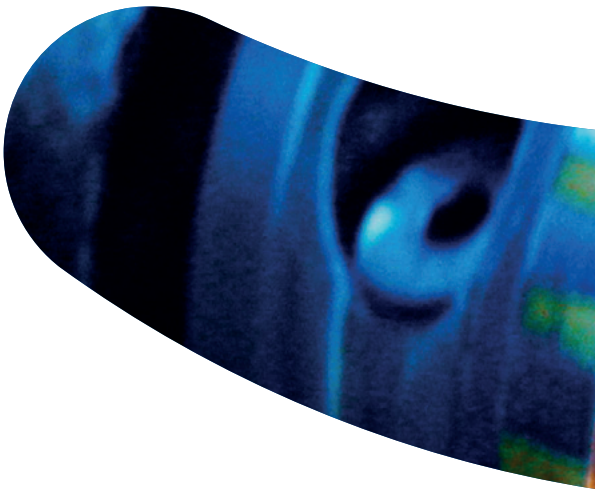
Istanbul Policy Center (IPC) is a global policy research institution that specializes in key social and political issues ranging from democratization to climate change, transatlantic relations to conflict resolution and mediation. IPC organizes and conducts its research under three main clusters: The Istanbul Policy Center–Sabancı University–Stiftung Mercator Initiative, Democratization and Institutional Reform, and Conflict Resolution and Mediation. Since 2001, IPC has provided decision makers, opinion leaders, and other major stakeholders with objective analyses and innovative policy recommendations.

About European Climate Foundation

The European Climate Foundation (ECF) was established as a major philanthropic initiative to help Europe foster the development of a low-carbon society and play an even stronger international leadership role to mitigate climate change. The ECF seeks to address the "how" of the low-carbon transition in a non-ideological manner. In collaboration with its partners, the ECF contributes to the debate by highlighting key path dependencies and the implications of different options in this transition.

About Agora Energiewende

Agora Energiewende develops evidence-based and politically viable strategies for ensuring the success of the clean energy transition in Germany, Europe and the rest of the world. As a think tank and policy laboratory, Agora aims to share knowledge with stakeholders in the worlds of politics, business and academia while enabling a productive exchange of ideas. As a non-profit foundation primarily financed through philanthropic donations, Agora is not beholden to narrow corporate or political interests, but rather to its commitment to confronting climate change.



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