# Energy Outlook





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## Abbreviations

bcm: Billion Cubic Meters **BOTAS:** Petroleum Pipeline Corporation **BPP:** Biomass Power Plant **CBRT:** Central Bank of the **Republic of Türkiye COP:** Conference of the Parties **EMRA:** Energy Market Regulatory Authority **EPİAŞ:** Energy Exchange İstanbul **ESCO:** Energy Service Companies EU: European Union **EÜAS:** Electricity Generation Company FSRU: Floating Storage and **Regasification Unit** GPP: Geothermal Power Plant **GW:** Gigawatt **GWh:** Gigawatthour HPP: Hydroelectric Power Plant IEA: International Energy Agency LNG: Liquefied Natural Gas MCP: Market Clearing Price **MENR**: Ministry of Energy and Natural Resources

MSP: Maximum Settlement Price MTOE: Million Tons of Oil Equivalent MW: Megawatt MWh: Megawatthour **NEEAP:** National Energy Efficiency Action Plan NPP: Nuclear Power Plant SMP: System Marginal Price SPP: Solar Power Plant **TEİAS:** Turkish Electricity **Transmission Company** TL: Turkish Lira **TPAO:** Turkish Petroleum Corporation **TSKB:** Industrial Development Bank of Türkiye TWh: Terawatthour **USA:** United States of America WPP: Wind Power Plant YEK: Renewable Energy Source YEKA: Renewable Energy Resource Area YEKDEM: Renewable Energy **Resources Support Mechanism** 

## **Presentation**

The fifth edition of the annual "Energy Outlook" report, the first of which was published by TSKB in 2018, is presented to beneficiaries with a relatively different approach this time. As followers are well aware, in the 2018 report, sectoral and subsectoral developments were presented to the attention of readers in a very extensive manner. In 2019, a more concise and focused report was published with a similar classification in order to avoid repetition. In 2020, as in the previous two years, various subcomponents of the energy sector (electricity, natural gas, oil, renewable energy and energy efficiency) were analyzed in detail, and the dominant and decisive trends in the energy market were also evaluated. Thematic titles of the 2020 report were the short-term impact of Covid-19 pandemic on the energy sector, Türkiye's hydrocarbon explorations, developments regarding the Renewable Energy Resource Area (YEKA) and the Renewable Energy Resources Support Mechanism (YEKDEM), rooftop and facade solar power systems, hybrid technologies, battery storage systems, electric vehicles, emissions as a national projection of energy-climate nexus and climate actions. In 2021, the same method was adopted, and this time the thematic topics were identified as offshore WPP, demand side management, hydrogen energy, electric vehicles and storage technologies, emissions and climate steps. The reports, which cover both annual developments and the economic and financial aspects of energy, as well as sectoral trends and future expectations in as much detail as possible, were followed with interest by sector stakeholders. We are particularly pleased to note that forward-looking projections and thematic reviews have been well received.

In 2022, a year characterized by a crisis in the energy sector and economic turmoil affecting the whole world, it was deemed appropriate to publish a report with a more compact content, outlining the developments in Türkiye. Rooftop SPPs and small modular reactors were analyzed as standalone themes during the year and published on the TSKB website as an information note. Developments such as fluctuations in the oil sub-sector, ruptures in the natural gas sub-sector, global price fluctuations caused by geostrategic ruptures, the temporary return to coal-fired power plants and the definition of nuclear power as a clean energy source, while the European Union (EU) is experiencing climate-oriented tightening, were closely monitored. In a conjuncture where the direction of all these processes is not yet clear, uncertainties remain, and making forecasts and projections are difficult, it was concluded that it might be useful to present an overall picture of Türkiye in a summary report this time. In addition, it was observed with satisfaction that important steps were taken in 2022, significant developments were experienced, and legislative arrangements were put into practice in the topics that were evaluated thematically in 2020 and 2021, and it was decided that new themes in addition to these themes would be shared with the public in 2023 as information notes.

As the year 2022, which historians in the field of energy are likely to describe as a turning point in the future, is behind us, the Energy Outlook report, which evaluates this year in the light of major developments with a focus on Türkiye, is presented to the attention and interest of all stakeholders with a renewed visual design.



# **Electricity Market**

Turkish electricity sector focuses on the principle of supply security at its heart and developed and continues to develop with an aim to contribute to economic growth and national prosperity. The electricity sector, which has a competitive model with multiple actors and unbundling of activities, today has a structure in which private sector actors are largely active and stands out with its competitive nature, strong dynamism, enriched and specialized human resources.

With both capital diversification and the accumulation of experience and management know-how, the Turkish electricity sector continues to evolve in line with the needs of the age and is changing according to global developments. With the increasing importance of combating climate change and geopolitical developments, the sector is focusing on issues such as expanding energy efficiency, diversifying energy sources, increasing grid resilience, demand side management, use of alternative fuels, evaluation of hybrid power plants and integration of storage technologies into the system. Although sensitivity to the changes in commodity prices remains valid, it is possible to argue that the electricity sector, when considered as a whole, is much more resilient and prepared against potential risks compared to previous periods.



## 2.1. Electricity Demand

The total demand for electricity in Türkiye between 2000 and 2021, excluding the years 2001, 2009 and 2019, did not decline and maintained a constant increase. Standing at 303.3 terawatthours (TWh) in 2019, the total demand for electricity materialized as 306.1 TWh as of the end of 2020. In 2021, a year of recovery after the Covid-19 pandemic, electricity demand increased by 7.7% to 329.6 TWh.





Graph 1: Development of Total Electricity Demand by Years



Graph 2: Comparative Breakdown of Monthly Electricity Demand

According to the monthly data released by Turkish Electricity Transmission Company (TEIAŞ), in the first half of 2022, increases continued to fluctuate both compared to 2021 and the average of the last five years. As seen in Graph 2, electricity demand has been showing a downward trend since July, albeit limited. After contracting by 5% year-on-year in July, Turkish electricity demand fell by 1.8% and 0.2% in August and September, respectively. In October, the most recent data released, the recession intensified and a contraction of 3.1% was experienced. Considering the first ten months of 2022 cumulatively, Türkiye's electricity demand was 276.6 TWh with a limited increase of 1.0% compared to the same period of the previous year. Based on the possibility of a 3% decrease or increase in electricity demand in the last two months, growth in annual electricity demand is expected to materialize in the range of 0.3%-1.3%.

## 2.2. Türkiye's Installed Capacity

Türkiye's total installed capacity was around 27.3 gigawatts (GW) as of 2000 but rose to 103.3 GW by the end of October 2022. Until 2021, incentives for power plants generating electricity from renewable energy sources and domestic resources played an important role in this increase. Türkiye's total installed capacity continues to increase.

Between 2011 and 2021, the average annual net increase in installed capacity stood at 4.5 GW. It is observed that the rise in installed capacity was higher than the total demand for electricity during this period and one of the major reasons is considered to be the incentives extended to renewable energy power plants. Annual average installed capacity of the renewable energy power plants commissioned between 2011 and 2021 stood around 3.2 GW.

Türkiye's total installed capacity reached 103.3 GW by the end of October in 2022. The net installed capacity increased by about 3,456 megawatts (MW) in the first ten months. This increase was attributable to power plants generating electricity from renewable resources. An installed capacity increase of 1,305 MW was achieved through hydroelectric power plants (HPP), 700 MW from wind power plants (WPP) and 76 MW from solar power plants (SPP). The net total installed capacity of natural gas and multi-fuel power plants decreased by 269 MW, while the net total capacity of imported coal plants increased by 1,380 MW.





Source:TEİAŞ, TSKB

## 2.3. Electricity Supply

Due to very low import and export volumes in the electricity sector, total electricity generation followed a parallel course with electricity demand. Major investments have been made from the beginning of 1980s so as to meet the rapidly-rising demand for electricity, thus leading to a considerable rise in the total gross electricity generation of Türkiye. In the last 20 years, gross electricity generation has contracted by 1.8% only in 2001 and 2009, with a limited increase of 0.4% in 2020. In 2021, a year of recovery, gross electricity consumption increased by 9.6% year-on-year to 334.7 TWh. This 2021 growth rate is the highest in the last 20 years.



Graph 4: Gross Electricity Generation by Primary Source by Years

Source: TEİAŞ, TSKB



According to data for the first ten months of 2022, gross electricity generation amounted to 274.9 TWh with a decrease of 1.3% compared to the same period of 2021. Compared to the average of 2017-2021, gross electricity generation in 2022 increased by 6.9% compared to the average of the same period of the last 5 years.

Power plants operating with imported and domestic coal were responsible for 33.0% of total gross electricity generation in the first ten months, while natural gas power plants were responsible for 22.2%. Natural gas power plants were followed by hydroelectric power plants with a share of 22.1% and geothermal, solar and wind power plants with 19.0%. Compared to the distribution in the first ten months of 2021, there was a 3.1 percentage point increase in the share of electricity generated from coal power plants and an 11.2 percentage point decrease in the share of electricity generated from natural gas power plants. Geopolitical developments are considered to have played a major role in the significant decline in the share of natural gas was offset by generated from renewable plants as well as coal plants. The share of electricity generated from HPPs and other renewable power plants increased by 4.5 percentage points and 2.6 percentage points, respectively.



#### 2.4. Electricity Prices

As stated in the "Energy Outlook 2021" report published by the TSKB Energy Working Group in 2021, electricity prices react immediately to changes in commodity prices, even though they depend on power plant availability, climatic conditions, economic and geopolitical factors<sup>1</sup>. The experience of this link was also observed in the price increases in 2022. The minimum and maximum limits of the Market Clearing Price (MCP), known as the electricity price, are set by the Energy Market Regulatory Authority (EMRA).

Due to the increases in natural gas and coal prices in global markets starting from April 2021, some natural gas and imported coal-based power plants were not able to come into operation based on the determined maximum limits. Therefore, the methodology of the maximum hourly price, which had been set at TL 2,000 /MWh for a long time, was changed. Through the resolution of EMRA issued on October 14, 2021, the maximum price limits were updated and while setting the maximum limits, it was decided to retrospectively apply the maximum price limits three times as the weighted averages of 12-month MCPs. starting from the calendar month two months prior to the current calendar month<sup>2</sup>. This update aimed to keep the natural gas and imported coal-based power plants, which experienced difficulties in getting into operation, within the system. In 2022, the increase in both natural gas and imported coal prices caused this limit to increase to TL 2,500 /MWh with the decision published in the Official Gazette of March 30, 2022<sup>3</sup>, to TL 3,250 /MWh with the decision published in the Official Gazette of May 19, 2022<sup>4</sup>, to TL 3,750 /MWh with the decision published in the Official Gazette of June 30, 2022<sup>5</sup>, to TL 4,000 /MWh with the decision published in the Official Gazette of July 29, 2022<sup>6</sup> and to TL 4,800 /MWh with the decision published in the Official Gazette of September 1, 2022<sup>7</sup>.

Accordingly, the monthly weighted average MCP and system marginal price (SMP) gradually increased throughout 2022 until September. In January 2022, the weighted average MCP was TL 1,176 /MWh and reached a peak value of TL 3,892.3 /MWh in September. In October, the weighted average MCP decreased slightly to TL 3,438.3 /MWh due to climatic conditions.

The weighted average of MCP, which decreased to TL 180 /MWh in 2020 due to the Covid-19 pandemic, started to increase in 2021 due to the increase in electricity demand, geopolitical developments in the world and increases in commodity prices. In this context, the weighted average MCP per MWh in 2020, which was TL 282.2, or USD 40.2, increased significantly in both TL and USD terms in 2021.

Graph 5: Monthly Weighted Average MCP/SMP



Source: TEİAŞ, TSKB

1TSKB Energy Outlook (2021). https://www.tskb.com.tr/uploads/file/energy-outlook-2021.pdf

<sup>1</sup>Resolution of the Board issued on October 14 was published in the Official Gazette No. 31629 of October 15, 2021. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2021/0/2021037.pdf <sup>3</sup>Resolution of the Board issued on March 29 was published in the Official Gazette No. 31649 of March 30, 2022. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2022/03/2023030-7.pdf <sup>4</sup>Resolution of the Board issued on May 18 was published in the Official Gazette No. 31840 of May 19, 2022. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2022/05/202203519-9.pdf <sup>4</sup>Resolution of the Board issued on June 29 was published in the Official Gazette No. 31840 of May 19, 2022. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2022/05/2022063-0.pdf <sup>4</sup>Resolution of the Board issued on June 29 was published in the Official Gazette No. 31840 of July 29, 2022. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2022/05/2022063-0.pdf <sup>4</sup>Resolution of the Board issued on June 21 was published in the Official Gazette No. 31840 of September 1, 2022. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2022/05/2022063-0.pdf <sup>4</sup>Resolution of the Board issued on August 31 was published in the Official Gazette No. 31940 of September 1, 2022. It can be viewed at: https://www.resmigazete.gov.tt/eskiler/2022/05/2022091-A.pdf <sup>4</sup>Resolution of the Board issued on August 31 was published in the Official Gazette No. 31940 of September 1, 2022. It can be viewed at: https://www.resmigazet.gov.tt/eskiler/2022/07/2022091-A.pdf



Graph 6: Development of Annual Weighted Average MCP

The weighted average MCP for 2021 was 508.5 /MWh in TL terms and 57.1 / MWh in USD terms. A large part of this increase was due to the increase in global natural gas and liquefied natural gas (LNG) prices in the last quarter of 2021. In 2022, following Russia's invasion of Ukraine, price pressure continued to increase. Accordingly, the weighted average MCP for the first ten months of 2022 was 2,324.5 /MWh in TL terms and 140.7 /MWh in USD terms.

In 2022, the unexpected rise in global raw material prices, especially for natural gas and coal, led to an energy crisis and rendered both natural gas and imported coal plants inoperable. In many countries, free markets have been intervened in. Tax concessions were extended to energy companies and state subsidies to consumers. In the first quarter of 2022, the cost of natural gas and imported coal increased further due to geopolitical developments, which brought to the forefront the need to take certain measures in Türkiye to ensure energy supply security. The "Support Fee Based on Source" model was put into effect for a period of 6 months in order to protect the consumer, to prevent excessive increases in electricity prices and to commission the inoperative installed capacity.

#### **Electricity Distribution and Retail Sales**

As of the last guarter of 2021, electricity purchase costs exceeded the national tariff, creating a cash crunch for electricity retail companies. In 2022, sales prices to these subscriber groups continued to remain below cost due to the impact of the increases in the national tariff, especially the limits imposed on residential and commercial subscriber groups. The cash crunch experienced by supply companies led to disruptions in their advance payments to Energy Exchange Istanbul (EPIAS), which in turn led to delays in payments to producers. In order to overcome this situation, some regulations have been put in place by EMRA and Electricity Generation Company (EÜAS). Among the regulations introduced by EMRA are the resource-based price cap and the obligation for supply companies to partially or fully withhold advance payments to EPIAS in July and August, and to pay 50% in the September-December period. EÜAS, on the other hand, announced that it would sell electricity in the day-ahead market for 3 months and 20 days starting from August 9, 2022 at a price of TL 1,100 /MWh to meet a portion of the K1<sup>8</sup> electricity demand of supply companies.



\*K1 type subscribers consist of subscribers who do not have the right to choose a supplier or who do not exercise this right even if they have the right to choose a supplier.

#### **Resource Based Support Mechanism**

According to the EMRA decision of March 18, 2022, which was published in the Official Gazette No. 31794 of March 30, 2022, the procedures and principles regarding the minimum and maximum price limits and determination in the day-ahead market and balancing power market were applied for 6 months as of April 1, 2022. With the decision published in the Official Gazette No. 31969 of September 30, 2022, it was stated that the said "Support Fee Based on Source" would be applied for 6 months as of October 1, 2022<sup>9</sup>. The Support Fee Based on Source model is based on transferring money from solar, wind and hydroelectric power plants with low operating costs to power plants with high operating costs such as imported coal and natural gas.

In the current bilateral electricity sales agreements, the documents and declarations requested by the market participants regarding the approved bilateral agreement notifications entered into the Market Management System for February 1 and later, before March 8, 2022 were submitted to the market operator. In the submitted contracts, if the duration of the contract is shorter than the implementation period, exemption is granted for the duration of the contract period, and if it is longer, exemption is granted for the implementation period subject to the Support Fee Based on Source. In November 2022, EMRA examined a large number of electricity sales contracts related to these exemptions and started the collection of TL 10-11 billions in violation of the legislation<sup>10</sup>.

#### Table 1: Maximum Settlement Price (MSP) Initial Value (TL/MWh)

Source	MSP Initial Value (TL/MWh)				
Jource	April 1, 2022	October 1, 2022			
Domestic Coal	1,200	2,050			
Imported Coal	2,500	2,750			
Natural Gas/Fuel Oil/Naphtha/LPG/ Motor Oil	2,500	4,500			
Other Sources	1,200	1,540			

#### Source: EMRA, TSKB



The initial values and date ranges of the ceiling prices applied/to be applied on the basis of resources are presented below:

The said MSPs are updated every month and are based on the Turkish Statistical Institute Producer Price Index, "ICE Rotterdam Coal Futures" closing index, Petroleum Pipeline Corporation (BOTAŞ) electricity generation facilities gas price, Central Bank of the Republic of Türkiye (CBRT) effective USD selling exchange rate and transmission system usage tariff.

Power plants included in YEKDEM, EÜAŞ power plants and power plants that have signed energy sales agreements with EÜAŞ and bilateral agreements signed before the start of the implementation are excluded from the Support Fee Based on Source application.

The power plants are classified according to their energy sources, and the amount of money they will pay or receive as "Support Fee Based on Source" is determined by the Maximum Settlement Price (MSP) parameter, which is differentiated according to the type of source, determined by EMRA. If the MSP determined for power plants such as WPPs or HPPs is lower than the MCP in the relevant month, the "Support Fee Based on Source" is paid, and if the MSP determined for power plants with high operating costs such as imported coal and natural gas is higher than the MCP in that month, the "Support Fee Based on Source" is shared.

<sup>9</sup>Resolution of the Board issued on September 29 was published in the Official Gazette No. 31969 of September 30, 2022. It can be viewed at: https://www.resmigazete.gov.tr/eskiler/2022/09/20220930-7.pdf <sup>10</sup>https://www.gazetedurum.com.tr/ekonomi/10-11-milyar-tlik-tahsilat-basladi-18714

## 2.5. Renewable Energy

Great importance is attached to renewable energy and energy efficiency in many countries around the world for creating a sustainable development route, supporting transition to a low-carbon energy system and mainstreaming clean energy. Renewable energy investments, which are among the most important components of green growth and decarbonization, have been on Türkiye's agenda for quite some time. When Türkiye takes decisive steps to sustain this momentum in renewables, especially wind and solar, it will be on its way to crossing a critical threshold on the path to decarbonization, especially through the reduction of the grid emission factor.

Diversification of generation and supply resources in order to render the energy system more flexible is among the main supply security policies of our country. In this context, renewable energy is of special importance in terms of diversifying resources, making better use of domestic resources and meeting energy demand with greener options.

#### 2.5.1 Renewable Energy Capacity

Türkiye's installed renewable energy capacity has been on an increasing trend over the years. Standing at 31.6 GW in 2015, installed capacity based on renewable energy resources increased by 8.7% on average per year to reach around 55.9 GW by October 2022 while its share within total installed power standing at 43.3% in 2015 rose to 54.1% by October 2022.

Source (MW)	2015	2016	2017	2018	2019	2020	2021	2022-10
Hydraulic	25,868	26,682	27,273	28,291	28,503	30,985	31,493	31,568
Wind	4,498	5,751	6,516	7,005	7,591	8,832	10,607	11,307
Solar	310	833	3,421	5,063	5,995	6,667	7,816	9,120
Geothermal	624	821	1,064	1,283	1,515	1,613	1,676	1,686
Biomass	345	467	575	739	1,163	1,485	2,035	2,219
Total	31,645	34,554	38,849	42,381	44,767	49,582	53,627	55,901

Table 2: Development of Renewable Energy Capacity (MW)

Source: TEİAŞ, TSKB

While HPPs had a share of 81.7% within the installed capacity of renewable energy resources in 2015, this share decreased over the years especially due to the increases in WPPs and SPPs. However, HPPs have the largest share in the installed capacity of renewable energy sources by 56.5% as of October 2022. With a rapid increase in the investments for unlicensed power plants in recent years, the shares of WPPs and SPPs in the installed capacity of renewable energy sources are 20.2% and 16.3%, respectively.

#### 2.5.2 Electricity Generation Analysis from Renewable Energy Sources

Electricity generation based on renewable energy sources, which was 84.2 gigawatthours (GWh) in 2015, rose to 118.6 GWh by 2021. In the first ten months of 2022, electricity generated from renewable energy sources was higher than the amount generated in 2021. The biggest factor in this increase is considered to be the fact that the total electricity generated from HPPs remained around 55.7 GWh for the whole year as a result of the drought in 2021 and that HPPs contributed more in 2022. In the first ten months of 2022, HPP generation increased by 23.7% compared to the same period of the previous year. Also in the first ten months of 2022, the share of renewable energy sources in total generation rose to 43.2%, thanks to the increase in electricity generated from HPPs and SPPs.



Source (MWh)	2015	2016	2017	2018	2019	2020	2021	2022-10
Hydraulic	67,146	67,231	58,219	59,939	88,886	78,095	55,695	60,733
Wind	11,653	15,517	17,904	19,949	21,515	24,513	30,986	24,697
Solar	194	1,043	2,889	7,800	10,542	11,977	14,194	20,260
Geothermal	3,425	4,819	6,128	7,431	8,230	9,316	10,106	7,177
Biomass	1,758	2,372	2,972	3,623	4,524	5,737	7,617	7,457
Total	84,176	90,982	88,112	98,742	133,697	129,638	118,598	120,324

#### Table 3: Development of Renewable Electricity Generation

Source: TEIAS, TSKB

Türkiye has significant resources in terms of wind, geothermal and solar power. Developing these resources is of vital importance in terms of both combating the climate change and reducing import and fossil fuel dependency in energy. The possibility of utilizing solar and wind resources in particular, with the impact of the electricity storage legislation enacted in the last two years, will trigger investments in these resources. In addition, with the capacity to generate its own energy and the commissioning of hybrid power plants, the trend towards renewable resources is expected to continue in the near term.

#### 2.5.3 Renewable Energy Resource Support Mechanism

Since the second half of 2021, prices in the TL-based YEKDEM have been changing every three months depending on macroeconomic developments. Prices set for Renewable Energy Resource (YEK)-certified generation facilities to be commissioned from July 1, 2021 to December 31, 2025 are updated quarterly every year in January, April, July and October, starting from January 1, 2021 and on a source basis. The first update dates to April 1, 2021.

As can be seen in Graph 7, the MCP in 2022 is significantly higher than YEKDEM prices. With MCP prices expected to remain high for a while due to geopolitical reasons, investors' appetite to participate in YEKDEM is suppressed. In this framework, the number of companies applying to YEKDEM in the Preliminary YEK List for 2023 published by EMRA decreased to 885 from 1,036 in 2021. In 2023, the total capacity planned to benefit from YEKDEM was materialized as 5 GW less than the total capacity in 2022<sup>11</sup>.





# 2.5.4 Renewable Energy Resource Areas (YEKA) Model

Source: TEIAS, TSKB

Thermal Disposal

Biomethanization

-Waste Ga

GPP

DAMP (Quarterly Average)

In 2016, the Ministry of Energy and Natural Resources (MENR) developed the YEKA auctions model in relation to large-scale investments for the transfer of the areas specified for electricity generation from renewable energy resources to investors on the condition that domestic-made equipment be used. YEKA projects in Türkiye support our country's strategy for supply security, domestic and renewable energy resources. These projects are also important for sustainable energy targets. In 2017, following the first tender, different tenders covering WPPs and SPPs were held and the MENR announced that the YEKA model would continue to be implemented. In this framework, new candidate YEKAs were announced on November 7, 2022 and November 22, 2022.

11 EMRA. https://www.epdk.gov.tr/Detay/Icerik/5-12859/2023-on-yek-listesi-hakkinda

#### 2.5.5 What Does the Electricity Storage Legislation Entail?

One of the most important challenges in the management of electricity is that it must be consumed as soon as it is supplied to the grid. Electricity storage systems are designed to provide ancillary services to the transmission system, including frequency control. Recent legislative amendments have clarified how the system will operate.

An amendment to the regulation on electricity storage activities was published in the Official Gazette No. 32018 of November 19, 2022<sup>12</sup>. With this amendment, generators that increase their capacity through electricity storage facilities will be able to sell the electricity they generate over the additional capacity within the scope of YEKDEM. Each legal entity that will build an electricity storage facility on its site is allowed to add wind or solar energy capacity up to the electricity storage capacity (within the framework of upper and lower limits).

According to the latest regulation, a maximum of 250 MW of pre-license applications can be made for both resources, while the minimum application for wind is 20 MW and the minimum application for solar is 10 MW. With the integration of electricity storage systems into the interconnected system, it will be possible to store the energy supplied to the grid by intermittent renewable energy sources, and it will be easier to manage the supply

demand imbalances that occur in instantaneous and hourly load management. This will lead to a more regular system frequency (i.e. electricity supply with the desired continuity and quality). All this will contribute to a relatively more vertical national load curve and prevent inefficient investments in the long run.



# **Natural Gas Market**

#### **3.1. Natural Gas Consumption**

When the amount of natural gas consumption in Türkiye in recent years is analyzed, it is seen that the highest consumption was materialized in 2021 with 58.9 billion cubic meters (bcm). Following a 23.3% annual increase in 2021, natural gas consumption in the first nine months of 2022 decreased by 4.5% compared to the same period of 2021. While the increase in 2021 may be attributed to the drought throughout the year, the total amount of natural gas to be consumed by the end of 2022 will be affected by variables such as the weather conditions for the rest of the year, the share of natural gas in electricity generation and the amount of natural gas that can be imported.



Graph 8: Development of Natural Gas Consumption

Source: EMRA, Natural Gas Distribution Companies Association of Türkiye (GAZBİR), TSKB



#### **3.2. Natural Gas Imports**

Türkiye meets almost all of its natural gas consumption through import. In 2021, 58.7 bcm was imported and 99.6% of natural gas consumption was supplied through imports. Imports in 2021 increased by 21.9% compared to the previous year, continuing the upward trend of 2020. During the first nine months of 2022, 41.5 bcm of natural gas was imported, increasing by over 3.1% year-on-year.

Graph 9: Development of LNG and Pipeline Shares in Natural Gas Imports



According to EMRA data, the share of LNG in Türkiye's natural gas imports declined from 31% in 2020 to 24% in 2021. In the first nine months of 2022, the share of LNG in Türkiye's natural gas imports was 24.5%. The 6-percentage point increase in the share of LNG imports compared to the same period of 2021 is attributed to Türkiye's decision to exit some of its long-term contracts and purchase natural gas from the spot market in 2021. In 2022, the increase in global natural gas prices had an upward impact on Türkiye's current account deficit as it procured more natural gas from the spot market.



Russia's share in natural gas imports, which averaged 54% between 2010 and 2018, declined to 33.6% in 2019 and 2020. However, the share of natural gas imported from Russia was 44.9% in 2021 due to the increasing demand. In the first nine months of 2022, the share of natural gas imported from Russia was 48.6%, 5.6 percentage points higher than the same period of the previous year. Iran, the second largest importer, had a 16.1% share in total imports in 2021. The amount of natural gas imported from Iran in the first nine months of 2022 was 7.1 bcm, equivalent to 17.1%. Natural gas imports from Iran amounted to 7.3 bcm in 2021. The share of the USA, another natural gas importing country, increased from 4.7% in 2019 to 8.5% and 8.1% in 2020 and 2021, respectively. In the first nine months of 2022, the share of USA rose above 10% with 4.3 bcm, thus overtaking Algeria.

#### 3.3. Natural Gas Storage

As a result of investments in the field of natural gas storage in Türkiye, significant increases were observed in both underground storage capacity and LNG terminal capacity. For this reason, the amount of natural gas stored has increased significantly over the years. Despite the aforementioned rises, the average annual consumption rate of storage capacities in Europe is 20% while this rate is around 4-5% in our country. 2018 was the year with the highest amount of natural gas stored, followed by a gradual decrease until 2021. In 2021, the total amount of natural gas stored increased slightly and was recorded as 29.2 bcm. In the first nine months of 2022, the amount of natural gas stored decreased by 0.9 bcm compared to the same period of 2021 and was 21.2 bcm.

bcm 40 35 30 25 20 37 30.0 29.2 15 27.0 10 5 2021-9 2022-9 2018 2019 2020 2021 Source: EMRA, TSKB

Graph 11: Development of the Amount of Natural Gas Stored

Underground storage activities, which play a critical role in ensuring the security and diversity of natural gas supply, have seen significant developments in recent years. There are two underground natural gas facilities in Türkiye. Among these facilities, Silivri Natural Gas Underground Storage Facility has a storage capacity of 3.2 bcm. By the end of 2022, the capacity of this facility was increased to 4.6 bcm<sup>13</sup>. With this expansion, the facility has become the largest storage facility in Türkiye. The second underground storage facility, the Tuz Gölü Natural Gas Underground Storage Facility, has a capacity of 1 bcm. The goal is to increase this capacity to 5.4 bcm in the near future.

In addition, the storage capacity of the four operational LNG terminals established to store, gasify and transfer liquefied natural gas (LNG) to the transmission line rose to 0.96 bcm. These are Marmara Ereğlisi LNG Terminal (1994-BOTA\$), Ege Gaz A.Ş. LNG Terminal (2006-Ege Gaz), Etki Liman LNG Facility (2016-Etki Liman) and BOTAS Dörtyol Floating Storage and Regasification Unit (FSRU) commissioned in 2017. Saros FSRU, which will enter the system as the fifth LNG terminal, is expected to be commissioned in January 2023<sup>14</sup>.



<sup>13</sup>Anadolu Agency. https://www.aa.com.tr/tr/gundem/cumhurbaskani-erdogan-amacimiz-ulkemizi-dogalgaz-referans-fiyatinin-olustugu-kuresel-bir-merkez-haline-donusturmektir/2765560 <sup>14</sup>Habertürk. https://www.haberturk.com/bakan-donmez-saros-korfezindeki-fsru-ocak-ayinda-devreye-girecek-3546939-ekonomi

#### 3.4. Natural Gas Prices

Natural gas prices in Türkiye are calculated in parallel with the prices in BOTAŞ's long-term contracts, oil prices and exchange rate movements. As there was not a free natural gas market in the past, the tariffs BOTAŞ imposed on eligible consumers and distribution companies were considered as the reference price within the wholesale network.

In the first quarter of 2021, global natural gas prices displayed a more stable trend, but started to move upwards in the second quarter of the year and became more volatile. In 2021, both Europe, Asia and the Americas experienced harsh winters and cold weather put upward pressure on natural gas prices. On the other hand, supply constraints in gas markets due to various technical and political reasons resulted in a gradual rise in prices on one hand and caused the depletion of Europe's natural gas stocks on the other.

Having started in Europe as of April 2021, the natural gas shortage deepened further due to the certain/limited quantity of natural gas that could be supplied through pipelines, leading to a rise in LNG demand. Spot market and LNG options were activated regarding the extra demand for natural gas. This caused LNG prices to increase more than expected. The increase in natural gas demand was not limited to Europe alone. Hurricanes in the USA in September restricted domestic generation, and an increase in natural gas demand was also experienced in Asia, all of which triggered competition concerning incoming LNG to Europe and resulted in a price hike. Therefore, price increases in Europe revealed the importance of clean energy alternatives for a balanced energy supply.

In February 2022, when Russia declared war on Ukraine, Europe's turn to other alternatives instead of the natural gas supplied from Russia continued to increase both spot natural gas prices and LNG prices. In March 2022, the TTF benchmark price rose to EUR 210 /MWh and reached EUR 320 /MWh in August. The milder weather in October and November eased natural gas prices slightly, but by December the TTF price was around EUR 140 /MWh.



#### Graph 12: Development of Natural Gas Prices

#### Source: Reuters, TSKB

All these global impacts related to natural gas were also observed in Türkiye as expected. In the coming months, the share of natural gas in Türkiye's electricity generation, natural gas consumption in industry, the amount of gas in storage and the development of air temperatures will be important for the course of natural gas prices.



# **Oil Market**

Türkiye's natural oil resources are limited and the country meets more than 90% of its need through imports. This situation is seen as one of the important reasons feeding the foreign trade deficit. Oil sector activities in Türkiye have gained momentum when compared to previous periods while oil and natural gas exploration projects have accelerated.



## 4.1. Oil Reserves and Production

As of end-2021, Türkiye's producible oil reserves stood at 411.2 million barrels, with the majority of the reserves located in the southeast of Türkiye. Most oil fields in Türkiye are old and well yields are falling steadily. Therefore, new technologies and practices to increase production efficiency and new drilling are of great importance. According to MENR and Turkish Petroleum Corporation (TPAO) data, 174 wells were drilled in 2021, while 150 wells were drilled in the first eleven months of 2022.

In 2022, three reserves of 180 million barrels were discovered, increasing Türkiye's total oil reserves to 600 million tons. In 2017, daily crude oil production was 40 thousand barrels, while in 2022, this figure increased to 65 thousand barrels. With the addition of the oil reserves discovered on Mount Gabar in December, daily oil production is expected to reach 100 thousand barrels in  $2023^{15}$ .

#### 4.2. Oil Consumption

Until 2017, consumption of oil and petroleum products showed an upward trend, decreased in 2018 and 2020, and increased by 8.3% in 2021 compared to the previous year. In 2020, the consumption of aviation fuels and fueloil types as well as total oil consumption decreased significantly due to the travel restrictions imposed in line with the measures taken in the wake of the Covid-19 pandemic. In 2021, consumption increased compared to 2020 as the effects of the pandemic subsided and the normalization process began.

In the January-September period of 2022, total petroleum products consumption increased by 6% compared to the same period of the previous year with 29.8 million tons. The increase in gasoline types and aviation fuels have a significant share in this increase.

Fuel Type (tons)	Consumption (Domestic Sales + Export)								
	2017	2018	2019	2020	2021	2021-9	2022-9		
Gasoline Types	5,470,652	4,769,778	5,391,574	4,225,303	4,705,951	3,316,504	4,046,405		
Diesel Types	24,399,381	23,722,846	27,023,444	27,839,527	28,829,208	21,087,598	19,860,635		
Fuel Oil Types	744,424	595,749	980,892	307,239	512,356	333,739	439,755		
Aviation Fuels	5,033,448	5,155,584	6,244,082	3,131,035	3,575,398	2,593,584	3,951,232		
Marine Fuels	2,138,390	1,829,355	2,437,245	644,814	1,272,880	810,453	1,558,956		
Kerosene	4,686	2,698	2,384	2,100	2,034	1,620	1,167		
Other Products	760,036	606,228	1,384,311	1,705,896	2,113,338	1,656,134	1,722,515		
Total	38,551,017	36,682,238	43,463,933	37,855,914	41,011,166	29,799,633	31,580,665		

#### Table 4: Consumption of Oil and Oil Products

Source: EMRA, TSKB

15 Anadolu Agency. https://www.aa.com.tr/tr/ekonomi/gabardaki-petrol-kesfi-turkiyenin-enerjide-bagimsizlik-politikasini-guclendirecek-/2762477

## 4.3. Crude Oil Imports

Following a decline in 2020, crude oil imports increased by 6.9% to 31.4 million tons in 2021. This increase continued in the first ten months of 2022 compared to the same period of 2021. In the first ten months of 2022, crude oil imports increased by 12.4% year-on-year to 28.6 million tons.



Graph 13: Development of Crude Oil Imports

According to EMRA data, 73.9% of the 31.4 million tons of crude oil imports in 2021 originated from Iraq, Russia and Kazakhstan. In 2021, Iraq's share in crude oil imports was 42.3%, followed by Russia with 17.3% and Kazakhstan with 14.4%. An analysis of the data published by EMRA for the first nine months of 2022 reveals that there has been no change in the order of the top three countries in total crude oil imports. Iraq's 40.2% share in crude oil imports in the first nine months of 2021 declined to 39.5% in the first nine months of 2022. The share of Russia, the second largest supplier, has increased significantly. Russia's share, which was 15.9% in the first nine months of 2021, increased to 30.6% in the same period of 2022. Kazakhstan's share decreased by 1.3 percentage points to 13.8% of crude oil imports.



#### 4.4. Crude Oil Price

As mentioned in the report titled Energy Outlook 2021 published by TSKB, there were dramatic declines in the barrel price of Brent oil in 2020 due to the Covid-19 pandemic, and the level of USD 20 per barrel were seen. In 2021, a year of recovery, the upward trend in the price of Brent oil began, and prepandemic prices were reached in the second half of 2021. The upward price movement that started in the last quarter of 2021, and the oil supply, which became more fragile with the Russian-Ukrainian war, caused the price of Brent oil, which eased somewhat in the third quarter due to weather conditions, fell to USD 93 in October.





Source: International Energy Agency (IEA), TSKB

# **Nuclear Energy**

Nuclear energy, one of Europe's alternatives to replace Russian natural gas, has been used for electricity generation all over the world since the 1950s. There are more than 430 active nuclear reactors generating electricity in 30 countries around the world. In particular, Europe's reintroduction of nuclear energy to reduce its natural gas imports from Russia and the recommissioning of reactors by some countries have brought nuclear energy back into the spotlight. Investments in nuclear power plants, which are of particular importance within the framework of the decarbonization target of the energy sector, are expected to become more of an agenda item with technological developments.

The nuclear energy source, which has been discussed in Türkiye's energy restructuring since the 1970s, comes into play with the Akkuyu Nuclear Power Plant (Akkuyu NPP), the works for which started in 2010. Consisting of 4 reactors, each with a capacity of 1,200 MW, the first reactor of Akkuyu NPP is planned to be commissioned in 2023. The plant is expected to be fully operational by 2027. With a total investment of USD 20 billions, Akkuyu NPP is expected to meet approximately 10% of Türkiye's total electricity consumption. In addition to the Akkuyu NPP, work is underway to invest in a second nuclear power plant.

While work on conventional nuclear power plants continues in Türkiye, some new studies are also attracting attention around the world. In particular, work on small modular reactors has accelerated. On the other hand, the progress in fusion technology recently announced to the world by the United States is likely to be much talked about in the coming years.



# **Energy Efficiency**

Energy efficiency means the most efficient utilization of resources at every stage of the processes from production to consumption of services and products. In other words, it is the prevention of energy losses that can occur in different forms such as heat, gas, steam, compressed air, electricity, and the reduction of energy consumption without adversely affecting production, services, physical comfort or social welfare through the use of developing technologies. In the shadow of the current energy crisis, it has become both a political and economic necessity for countries to have a secure energy supply. Energy efficiency, which can meet climate targets, security of economy and supply at the same time, is seen as the most important policy component for countries to solve the energy crisis. For this reason, most countries are accelerating energy efficiency actions to minimize the impact of the energy crisis.



## 6.1. Developments in the World

According to the "Energy Efficiency" report published by the International Energy Agency (IEA) in 2022, total energy efficiency investments are expected to reach USD 560 billion, an increase of 16% compared to 2021<sup>16</sup>. Under current policies, this figure is projected to increase by a further 50% per year from 2026 to 2030, reaching around USD 840 billion.

Today, energy performance standards are used in more than 80 countries, but they fall short of the technological potential available and are not sufficient to deliver the improvements needed. Energy Star and the Corporate Average Fuel Economy program in the US, the Energy Efficiency Directive and the concrete improvement programs shaped within the framework of the said Directive in the EU, various initiatives in Japan with their origins in the "Top Runner" application stand out as the main practices, while Australia and New Zealand also put forward their own energy efficiency efforts.

On the other hand, China's "Top 10,000 Program" supports the progress of more than 10,000 large companies operating in energy-intensive sectors towards energy saving targets and closely monitors improvements. China, known for its support to energy service companies (ESCO), is increasingly promoting energy efficiency with more aggressive approaches.

Decisions have been taken in the EU to increase energy efficiency as of May 2022. In its "REPowerEU" plan to increase the security of energy supply and reduce dependence on Russia, the European Commission proposed to increase the EU energy efficiency target from 9% to 13% and the renewable energy target from 40% to 45% for 2020<sup>17</sup>. The issue of updating the Renewable Energy Directive and the Energy Efficiency Directive was on the agenda of the European Parliament's Plenary Session in Strasbourg in September. The European Parliament has demanded that Member States reduce their final energy consumption to be measured in 2030 by at least 40% compared to 2007 and increase the renewable energy target set for 2030 from 40% to 45% in order to boost energy efficiency practices<sup>18</sup>.



<sup>16</sup>IEA (2022). Energy Efficiency. https://iea.blob.core.windows.net/assets/7741739e-8e7f-4afa-a77f-49dadd51cb52/EnergyEfficiency2022.pdf

17 European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip\_22\_3131

<sup>18</sup>European Parliament. https://www.europarl.europa.eu/news/en/press-room/20220909IPR40134/parliament-backs-boost-for-renewables-use-and-energy-savings

## 6.2. Developments in Türkiye

Within the framework of EU harmonization efforts, the first National Energy Efficiency Action Plan (NEEAP) covering the period between 2017 and 2023 was published in the Official Gazette No. 30289 of January 2, 2018 as the High Planning Council Decision No. 2017/50<sup>19</sup>. Covering 55 actions to be implemented between 2017 and 2023 under the categories of buildings and services, energy, transport, industry and technology, agriculture and horizontal matters, the NEEAP aims to reduce primary energy consumption by 14% by 2023 (savings of 23.9 million tons of oil equivalent (MTOE)).

In line with the EU Green Deal, the Green Deal Action Plan was published in the Official Gazette No. 31543 of July 16, 2021 as a road map with the Presidential Circular in order to ensure the green transformation of our country and to strengthen or protect its exports with other countries, especially with the EU<sup>20</sup>. The plan aims to evaluate Türkiye's renewable energy and energy efficiency efforts within the framework of the updated amendments to the European Green Deal, to examine areas for improvement, to inform and raise awareness in the industry, and to prepare a roadmap for the dissemination of energy efficient and low emission heating and cooling systems<sup>21</sup>.

"Energy Performance Contracts", which is successfully implemented in many developed countries around the world and enables efficiency-enhancing projects to be implemented without any investments and with a share of guaranteed future savings, can be defined as the most important of creative project finance methods. Unfortunately, Türkiye has not made significant progress in this area, despite the fact that it is supported by many international finance institutions and recommended with strong instruments.

<sup>19</sup> Published in the Official Gazette No. 30289 of January 18, 2018. It can be viewed at: https://www.resmigazete.gov.tr/eskiler/2018/01/20180102M1-1-1.pdf

https://www.resmigazete.gov.tr/eskiler/2021/07/20210716-8.pdf

<sup>21</sup> Ministry of Trade. (2021). Green Deal Action Plan.

https://ticaret.gov.tr/data/60f1200013b876eb28421b23/MUTABAKAT%20YE%C5%9E%C4%B0L.pdf

Sector-based energy efficiency developments are also ongoing in Türkiye. The main, but not all, developments are summarized below.

<sup>&</sup>lt;sup>20</sup> Published in the Official Gazette No. 31543 of July 16, 2021. It can be viewed at:

#### **Buildings and Services Sector**

- Communiqué on the Implementation of Energy Performance Contracts in the Public Sector was published. (Energy performance contracts up to 15 years for public institutions and organizations for projects with an investment value of TL 2 millions or more)
- Amendment to the Regulation on Energy Performance in Buildings entered into force. (Buildings with a total construction area of 2,000 m2 or more should be constructed as almost zero-energy buildings, the Energy Performance Certificate class should be at least B or better, and at least 10% of the buildings' primary energy needs should be met from renewable energy (2023-2025 transition period))
- Communiqué on the Implementation of the Green Certificate for Buildings and Settlements was published.
- The 2020 Presidential Circular set an energy saving target of 15% by the end of 2023.

#### Industry and Technology Sector

- An obligation of feasibility studies was introduced for industrial enterprises with thermal energy needs of 20 MW or more for the implementation of cogeneration systems.
- Within the scope of energy management, monitoring, analysis and projection studies carried out in energy-intensive sectors, benchmarking reports were prepared for the first time in the iron and steel, glass, food (sugar) and textile sectors, in addition to the cement sector. Guidance documents were also drafted for the preparation of sectoral benchmarking studies.
- Within the scope of harmonization with EU technical legislation, the Framework Regulation on Energy Labeling was published. In addition, 14 communiqués for implementation on electrical-electronic products (products such as cooling devices, household dishwashers and washing machines, electronic displays, computers, servers, welding equipment) were published in the Official Gazette.

#### **Energy Sector**

- In July 2022, an amendment to the regulation introduced a feasibility studies obligation for the implementation of cogeneration systems in newly established industrial enterprises and thermal power plants with an installed capacity of 20 MW or more.
- The technical assistance project for improving the energy efficiency of the natural gas transmission system was completed.
- Within the scope of the National Smart Meters Project, the first field installations took place in Samsun province in June 2022.
- Within the scope of the Harvesting Energy Efficiency in the Electricity Distribution Sector Phase-2 Project, the Transformer Efficiency Platform was established to analyze the efficiency status of transformers owned by electricity distribution companies and the potential to be achieved.
- With the legislative arrangements made in 2020, LED application was made mandatory in parks and gardens, and LED application was started in new facilities to be built in general lighting. In this context, the first applications were completed in 2021 and 7,050 LED applications were made by electricity distribution companies as of September 2022.

#### **Transportation Sector**

- Tax advantages were provided for zero emission vehicles.
- Electric Vehicles and Electric Vehicle Charging Systems Basic Terms and Definitions Standard was prepared and the Law No. 6446 was amended regarding the establishment of the charging infrastructure.
- The Regulation on Electric Scooters was published.
- The Bicycle Path Master Plan, covering a route of 3,165 kilometers, was prepared.
- Ongoing in 30 metropolitan municipalities, the number of Park-and-Ride applications reached 76.
- Restrictions were imposed on commercial vehicles carrying freight to enter the designated routes or the city center during certain hours.
- Directive on Additional Safety Requirements for Turkish-Flagged Ships to be Equipped with Electric (Lithium-Ion Battery System) or Hybrid Technology was published.

#### **Agriculture Sector**

- The Pilot Project on Increasing Energy Efficiency in Irrigation Pumps was implemented.
- A total of 255 unlicensed generation applications were made by agricultural irrigation subscribers based on solar energy, 21 with land application and 234 with rooftop and facade application. The total capacity of these applications reached 93 MW.