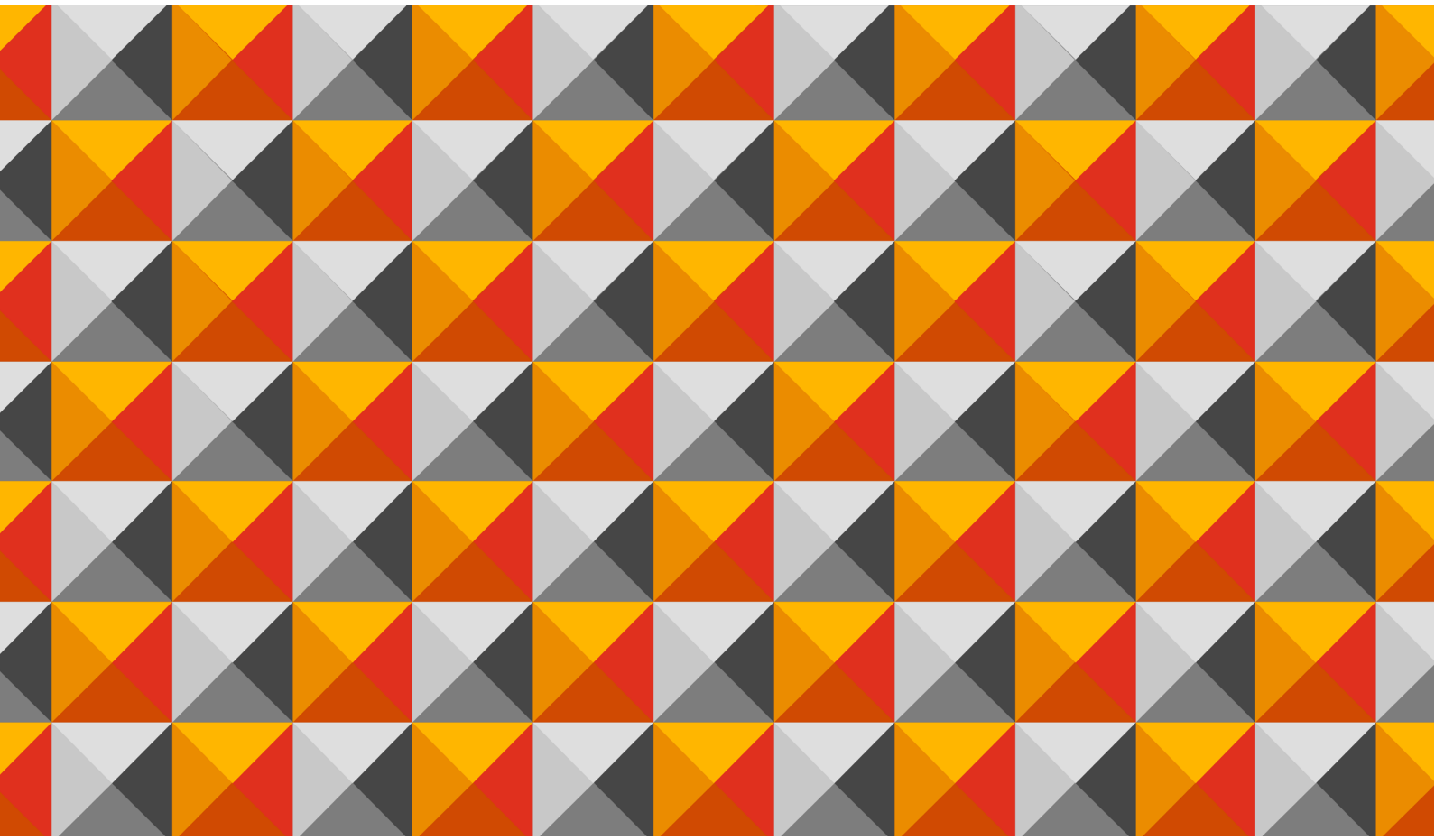
Overview of the Turkish Electricity Market

September 2023

pwc



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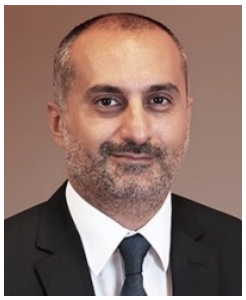

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Turkish electricity sector experienced several challenges over the last 3 years.

Unlike most other countries, electricity demand in Türkiye stood firm at the face of Covid-19 pressure. 2021 saw a rapid increase in electricity consumption due to a rebound in economic activity as Covid-19 impact started to neutralize. Like all other countries in Europe, Türkiye experienced soaring electricity prices especially during the last quarter of 2021 and throughout 2022. The depreciation in Turkish lira only added to increasing electricity prices and authorities had to take certain measures to control the inflationary impact on corporates and households. Despite all challenges, regulators and investors continued to announce new investments, targets and legislations to organize the introduction of new technologies and services into the ecosystem, which are overall intended to support the adoption of renewable energy technologies on a more widespread and sustainable scale. Regulators strongly outspeak their commitment to Türkiye's net zero targets and Türkiye is closer, than ever before, to experiencing a significant increase in the field of new activities supporting low-emission and sustainable green electricity.

PwC Türkiye updated this public document, first issued in 2020, to factor in the latest developments Türkiye experienced through 2022 and 2023 in its electricity sector. This document is intended to provide background to dynamics constituting the electricity sector whilst also elaborating on the latest developments. The information in this assessment is collected from various public resources controlled by market regulators, all of which possess high standards of transparency.

We hope the industry stakeholders as well as all other parties find our research useful in understanding the dynamics of the Turkish Electricity Market. Our sole purpose in publishing this research is to be able to help raise more awareness among the public towards the Turkish Electricity Market and contribute to its development by creating another source of clearly visualized and explained industry data.

1

Market Background & Timeline

The development of the Turkish electricity market can be split into three stages. Market is in the **late Growth Stage, setting the screen for Green Transition Chapter**, during which main focus will be on decreasing carbon emissions at the face of growing electricity demand.

Development Stages

Early Stage (1920s-1960s)

- Stage characterized by the lack of long-term/full scale planning and a need for more active involvement by the regulatory authorities
- Municipalities and private companies active in generation and distribution.

Structuring Stage (1960s-2000s)

- Start of long-term planning, significant capacity increases as well as beginning of market liberalization, increasing share of IPPs
- Regulatory authorities appear for the first time: Turkish Electricity Administration (TEK), Ministry of Energy and Natural Resources (MENR)

Growth Stage (2000s-Ongoing)

- Enactment of the Turkish Electricity Market Law,
- Amendment of Renewable Energy Law to make way for the introduction of incentives for renewable energy,
- Founding of the Energy Market Regulatory Authority and the organized electricity market.

Key Themes

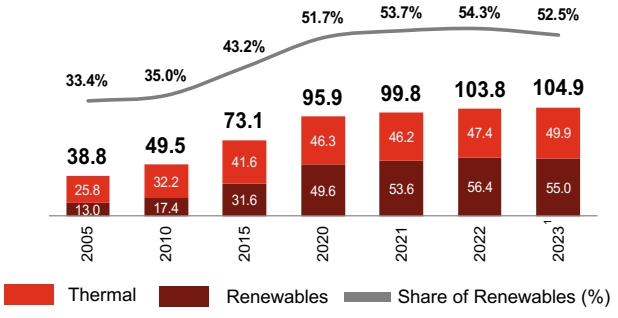
- Minimal state intervention,
- Electricity demand gradually increasing with growing population and infrastructure requirements,
- Focus on building and spreading the country's electricity network,
- Municipalities and private companies active in generation and distribution.

Emergence of BOT/TOR/BOO concepts and privatizations,

BOT	Build	Operate	Transfer
TOR	Transfer	Operating	Rights
BOO	Build	Operate	Own

Graph 1

Installed Capacity by Source Type (2000-2023, GW)



Green Transition Chapter – Key Themes

1. Reinforce renewable electricity generation capacity
2. Introduce new technologies to support renewable share increase
3. Continued yet "controlled" reliance on fossil fuel alternatives
4. H_2 Explore the role of hydrogen and other alternative fuels in changing energy landscape

[1] June 2023 Installed Capacity Data

Türkiye's commitment to Green Transition can be best observed in the National Energy Plan prepared and submitted in May 2022.

In October 2021, Türkiye has signed the Paris Agreement and subsequently announced its commitment to achieve an economy with **Net Zero Greenhouse Gas emissions** by **2053**. National Energy Plan summarizes MENR's perspective on targets that need to be met until 2035 in order to secure the achievability of 2053 vision.

Installed capacity targets estimate the share of renewables at 65% in 2035 (54% as of March 2023). Solar power having the biggest share with 53% in renewable installed capacity.

Compared to 2000 levels, energy density is expected decrease by 51% as of 2035 which is similar to ratios observed in Germany and France.

No specified date for coal phase-out, and the introduction of additional installed coal installed capacity.

According to MENR's National Energy Plan, some key targets for 2035 are set as below:

Installed Capacity for Selected Technologies

52.9 GW	29.6 GW	7.2 GW

35.3% decrease in the **electricity density** by 2035

Türkiye's Nationally Determined Contribution (NDC)

Compared to 2012, greenhouse gas emissions is estimated to decrease by 41% by 2030

MENR also announced its **Hydrogen Technologies Strategy and Roadmap** in January 2023. MENR foresees a relatively limited capacity for Türkiye compared to EU countries, around 2 GW by 2030. However, once the local manufacturing capabilities for electrolyzer production and hydrogen transmission/storage are developed, MENR estimates 70 GW installed capacity for electrolyzers by 2053.

Electricity Generation Targets, Renewables Share

%	'23	'35
Ren.	42	55

Graph 2

Electrolyzer and Battery Capacity Targets for 2035 (GW)

Source: Türkiye's National Energy Plan

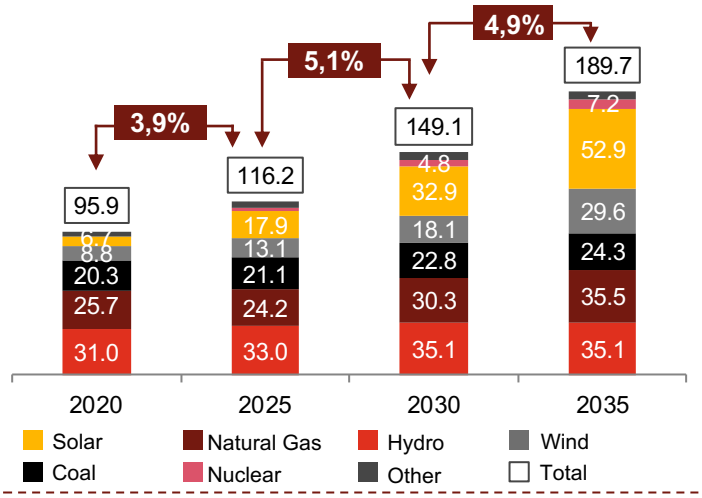
Share of renewables in generation is expected to exceed on a sustainable basis after 2030, decreasing dependency on thermal is a visible theme in National Energy Plan targets.

Despite an **increase** in the **installed capacity** of **thermal energy** in the projection period, a **decrease** in its **usage** rates can be obsvered. Along with this decline in thermal energy usage, a **reduction** in the **electricity-caused carbon emissions** can be expected.

Increase in the integration of renewable energy sources, leads to an increased need for flexibility and energy efficiency. Battery storage technologies and electrolyzers can meet the need for flexibility.

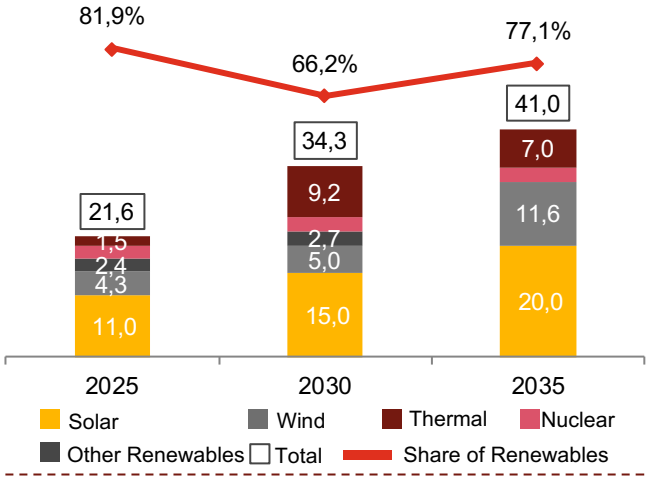
Graph 3

Installed Capacity by Source (GW)



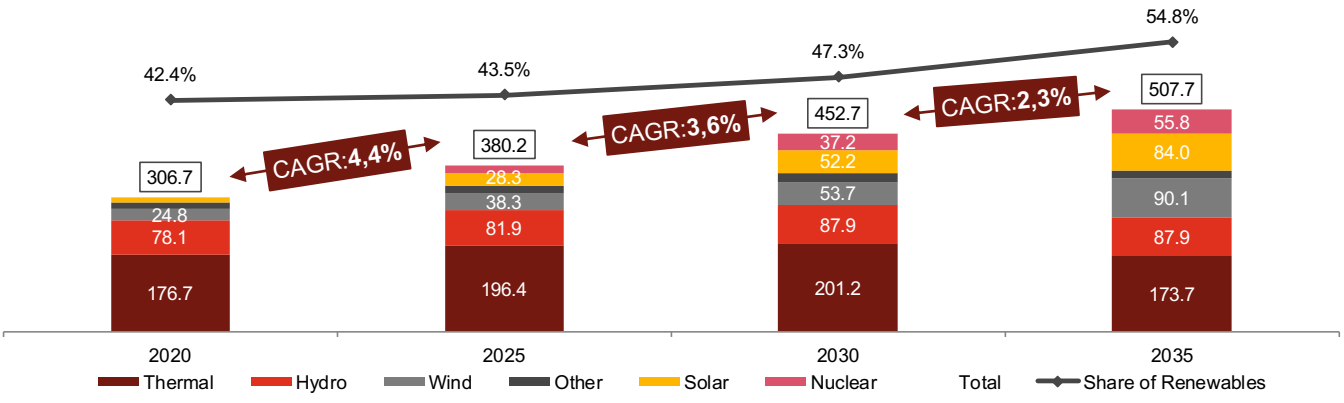
Graph 4

New Capacity Commissioned in 5-year Periods (GW)



Graph 5

Electricity Generation by Source (TWh)

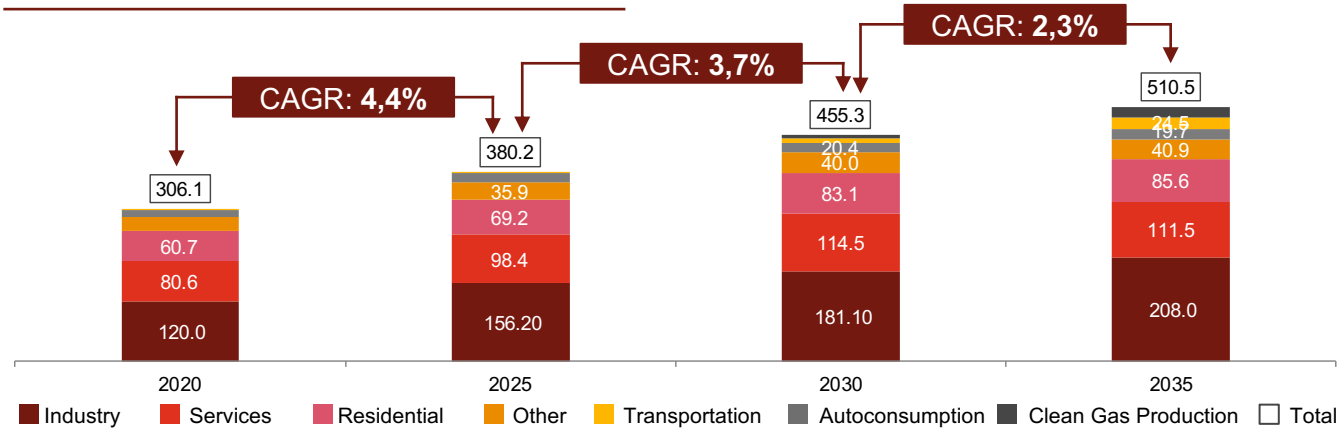


Source: Türkiye's National Energy Plan

In 2035, Türkiye's annual electricity consumption is projected to surpass 500 TWh and the industry and service sectors are expected to constitute more than 50% of the total consumption.

Graph 6

Electricity Consumption by Sector (TWh)



In the projection period (2025-2035), **Transportation** stands out as the fastest growing sector in electricity consumption, expected to consume electricity at a **27.8%** growth rate (2020-2035 CAGR). The adoption of electric vehicles and electrification of different means of public transportation are expected to significantly contribute towards the goal.

Other Considerations from National Energy Plan

- There is **no specific date** given for a **coal phase-out**, projected **increase** in the **installed capacity** of **coal-fired power** plants.
- Since the national energy plan was published in **late December 2022**, it is not clear whether projections (**7.5 GW in 2035**) accurately reflect recent investor appetite.
- In line with the net zero targets, **EV** market is expected to experience a **gradual development**. Thus, the share of **transportation** sector in electricity consumption is expected to increase from **1%** in **2020** to **6%** in **2035**.
- The share of **Nuclear energy in installed capacity** is expected to reach a share of nearly **30%** in **2053**. This indicates an **35-40 GW** increase in the Nuclear power compared to **2035 levels** (**7.2 GW** capacity in **2035**).

Source: Türkiye's National Energy Plan

Growth Stage Timeline

2001
- Electricity Market Law
- Establishment of EMRA

2006
- Establishment of the Organized Electricity Market

2011
- Amendment of Renewable Energy Law
- Start of unlicensed Electricity Generation

2013
- New Electricity Market Law
- Completion of the Privatization Process of Distribution Assets

2016
- First YEKA Tenders Announcement
- Power Purchase Guarantee for Lignite Power Plants

2017
- First Wind and Solar Power YEKA Tenders Completed

2018
- EÜAŞ-TETAŞ Merger under EÜAŞ
- Ancillary Services Market
- Capacity Mechanism Enters Into Force

2019
- Introduction of the new unlicensed generation regulation
- YEKA WPP-2 tender completed
- Expiration of the majority of BO and BOT Agreements

2020
- Announcement of the new Mini YEKA SPP-3 competition
- Announcement of Green Tariff

Recent Past

2021
- Announcement of new Mini YEKA WPP-3 (2021) and Mini YEKA SPP-4 (2022)
- Establishment of Power Futures Market and YEK-G Certificates & System
- In October 2021, Türkiye has ratified the Paris Agreement.

2022
- YEKA WPP-3 (with a capacity of 850 MW) and SPP-4 (capacity of 1 GW) tenders were concluded.
- EMRA introduced resource-based price cap mechanism on Apr. 2022. The mechanism sets a cap to market clearing prices (different for each source) for all the power plants, lower for plants on renewable sources. The resource based price cap mechanism is still in effect.
- Enerjisa Üretim signed a turbine purchase agreement with Enercon in order to realize its 1 GW WPP investment, which covers all of the YEKA WPP-2 tenders (planned to be completed in 2024).
- EMRA first introduced hybrid model regulation in late 2020.With the additional measures, the legislation was adjusted in 2022. As of May 2023, a total capacity of 2,4 GW has been allocated.
- EMRA announced its Draft Charging Services Regulation on Apr. 2022. As of June 2023, 130 companies obtained a license to operate charging network.
- EMRA announced Electricity Storage Regulation on May 2022. As of June 2023, the storage capacity applications exceeded 275 GW. Around 270 pre-licenses have ben issued by EMRA as of June 2023.

2023
- Türkiye and Bulgaria has signed a transmission agreement of up to 1.5bcm of natural gas per year (first long-term and high amount NG agreement of Türkiye).
- MENR published Türkiye's National Energy Plan (towards NZ53 commitments) and country's Hydrogen Technologies Strategy & Road Map.
- On May 1st 2023, the new YEKDEM scheme has been announced. Power plants that will be operational from July 2021 until the end of 2030 can benefit from the FiTs.

Market Value Chain – Conventional Players

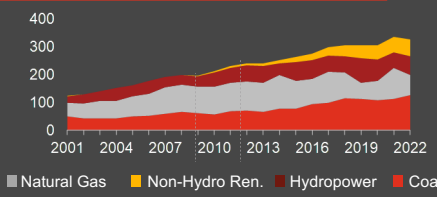
Generation → Transmission → Wholesale → Distribution → Retail

Generation

Both state-owned and independent power producers who hold generation licenses are permitted to generate electricity. **EÜAŞ** owns and operates the state-owned power plants. The total installed capacity of Türkiye was **104.9 GW** as of June 2023.

Graph 7

Electricity Generation by Source (TWh)



Transmission

Transmission Line Length
73,806 km (2023)

Transmission Losses
1.9% (2022)

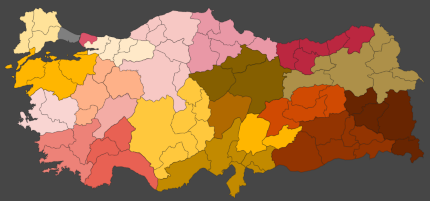
TEİAŞ is the state-owned monopoly that owns and operates the electricity transmission in the country. It is also responsible for operating the balancing power market and the ancillary services market.

Wholesale

Private and state-owned companies are responsible for wholesale activities. **EÜAŞ** (after its merger with TETAŞ in July 2018) is a state-owned wholesale company responsible for selling electricity to market players.

Key Players:

- EÜAŞ
- EPİAŞ
- Private Wholesalers
- Over the Counter (OTC) Market



21 Distribution Regions

Distribution

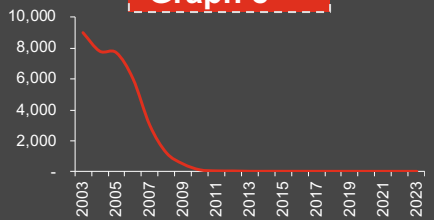
Distribution systems are responsible for the transportation of electricity over shorter distances in lines below 36 KW (low and medium voltage). There are a total of 21 distribution regions, all of which have been operated by private entities since 2013. These companies operate based on the operational rights contracts signed with TEDAŞ.

Retail

Retail refers to sale of electricity to end consumers. Companies with a retail license can sell to users without distribution zone restrictions. Consumers with consumption that exceeds the annual eligible consumer limit (**1,000 kWh** as of 2023) have the right to choose their suppliers. The designated retail suppliers in each distribution region are responsible for meeting the electricity demand of consumers who do not prefer to use their eligibility rights, with the demand being supplied through the national tariff.

Eligible Consumer Limit, (kWh)

Graph 8



Source: EMRA, TEİAŞ, EPİAŞ

Market Value Chain – New Players

The Turkish electricity market value chain welcomed new entrants in the last couple of years. New entrants are expected to facilitate progress through Green Transition Chapter.

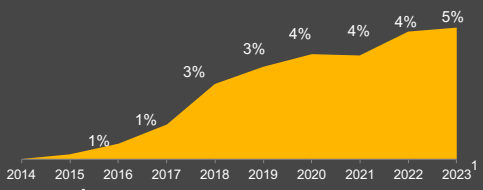
Generation

Private and public companies and institutions that consume electricity at large amounts in their operations can build and operate **unlicensed power plants**, in order to ensure access to steady and green energy and mitigate volatile energy costs.

Unlicensed generation source does not need to be constructed in the same location as the consumption point. Unlicensed solar power plants can be built either on the ground or on the roof of the consumption point. In case the amount of electricity generated is more than twice the consumption, additional power is given to YEKDEM for free.

Graph 9

Share of Unlicensed Electricity Generation in Total Generation (%)



As per TEİAŞ information, the share of unlicensed generation in total generation showed a stable trend after 2021. That is stemmed from the fact that during and after 2021 most unlicensed power plant investments are fully focused on autoconsumption.

Storage capacity applications to EMRA exceeded **275 GW** as of **June 2023 with more than 4,000 applications**

Around 270 pre-licenses have been issued with a combined capacity of **as high as 18 GW** as of **June 2023.**

With the new legislation, firms that receive a license to establish an electrical storage facility will have the license to build and operate a wind **(min. 20 MW)** or solar power plant **(min. 10 MW and max 250 MW)** with the same capacity of the storage facility.

The main benefits of storage facilities are balancing the grid load, avoiding imbalance costs and allowing its users to benefit from arbitrage opportunities.

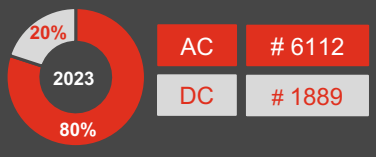
Transmission

Distribution

Several ventures in Türkiye have been investing in building EV charging network stations for at least a couple of years. The legal framework was approved and EMRA started to distribute licenses for the charging stations on 2022 May.

Charging License Requirements:

- **3.7 million TL/MWh** equity investment
- Establishment of **50+ charging units** in **at least 5** different **cities within 6 months**



As of June 2023, there are **7,501** charging points that provide charging services for commercial electric vehicles.

[1] LTM of June 2023

Source: EMRA, TEİAŞ, TEHAD

8,001 charging units as of June 2023. It is expected reach **10.000** units **by the end of 2023**

A total of **132 firms licensed** to operate **EV charging network** as of June 2023

EV sales reached 10,028 in first six months of 2023 and 8,210 in 2022 whereas in 2021 EV sales amounted 2,849. **BMW** and **Mercedes Benz** were the most sold EV brands in Türkiye. **TOGG** (a national initiative), **Tesla** and various Chinese brands entered **Turkish EV market** in **2023**.

Several public institutions are responsible for the regulation and operation of the electricity market.

Key Public Institutions

MENR

Strategy and Policy Maker

The Ministry of Energy and Natural Resources is the main governmental body responsible for carrying out energy policies.

EMRA

Independent Regulator

The Energy Market Regulatory Authority is responsible for regulating and supervising the electricity, natural gas, and liquefied petroleum gas markets.

TEİAŞ

Transmission Operator

The Turkish Electricity Transmission Company is the state-owned monopoly that owns and operates electricity transmission in the country. In addition, upon attaining the "Transmission License'' from the Energy Market Regulatory Authority (EMRA) in 2003, the company became responsible for managing nationwide regional directorates and local dispatches. It is also responsible for the operation of the power balancing market and the ancillary services market.

EÜAŞ

Public Generation

The Electricity Generation Company owns and operates the state-owned power plants and following July 2018 also took over the wholesale trading responsibilities of TETAŞ (former state-owned wholesale electricity company).

EPİAŞ

Market Operator

The İstanbul Energy Exchange is the market operator responsible for operating the day-ahead, intraday, power futures spot gas, gas futures and balancing markets in the country, and has managed the eligible consumers in the spot markets since 18 March 2015. Furthermore, EPİAŞ oversees some of operations regarding renewable energy such as YEK-G system and YEKDEM. In addition, it provides comprehensive, real-time data for the electricity and natural gas markets with the EPİAŞ Transparency Platform. This platform provides transparency in these markets as well as equal access to the data for market participants.

Source: MENR

The Turkish electricity market reform began in March 2001 with the enactment of Electricity Market Law (EML) No. 4628, which aimed to introduce competition and maintain sustainable growth in the market.

The purpose of the market law is to provide consumers with continuous electricity at an affordable price. The law established EMRA, which functions as an autonomous body responsible for regulating the electricity market.

Later, the functions of EMRA were extended to cover the natural gas, liquefied petroleum gas and petroleum markets. EMRA performs its duties through the Energy Market Regulatory Board which is the main decision-making body.

Also in 2001, the Turkish Electricity Generation and Transmission Company (TEAŞ) was unbundled into the three parts:

Electricity Transmission Company (TEİAŞ)

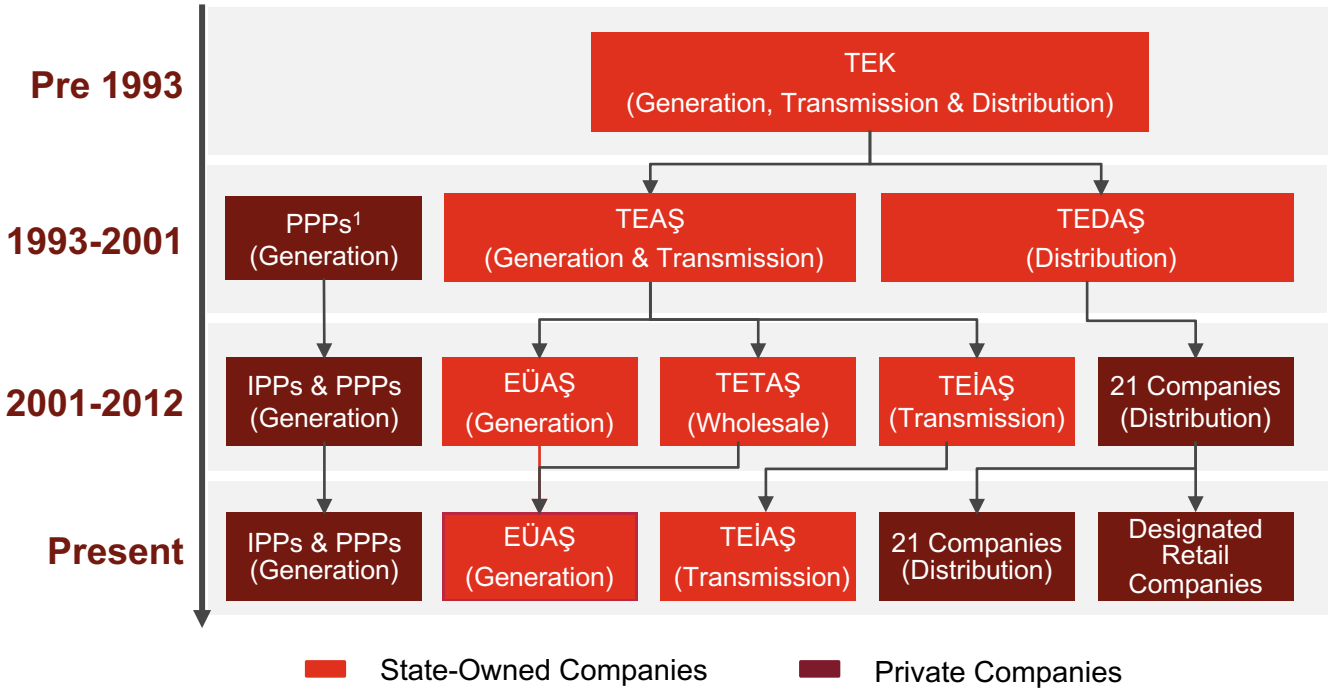
✓ Developing, maintaining and operating electricity transmission system

Electricity Generation Company (EÜAŞ)

✓ Operating state-owned electricity generation capacity

Electricity Trading and Contracting Company (TETAŞ)

✓ Wholesale electricity trade including the long term PPA's with BOT and TOR companies



[1]The emergence of IPPs essentially started with the introduction of BOT and TOR power plants in the 1990s. Gradually as the necessary regulations were developed for greater participation from the private sector, IPPs began developing their own greenfield investments. Further details on the privatization timeline of the electricity market can be found in the report.

Source: EMRA, TEİAŞ, EPİAŞ

2

Electricity Demand Analysis

Consumption in the Turkish electricity market grew rapidly until the end of 2018. In 2019 and 2020 electricity consumption nearly remained unchanged. After a drastic increase in 2021, due to post-covid rebound impact, electricity consumption experienced a slight decrease in 2022 due to a mix change in economic activity, with the share of services increasing.

Analysis of 10-Y Moving Average (MA) Growth of Electricity Demand does not include the period from 2019 onwards since the period characteristics can distort the image.

(1) 2020 was distorted by Covid-19,

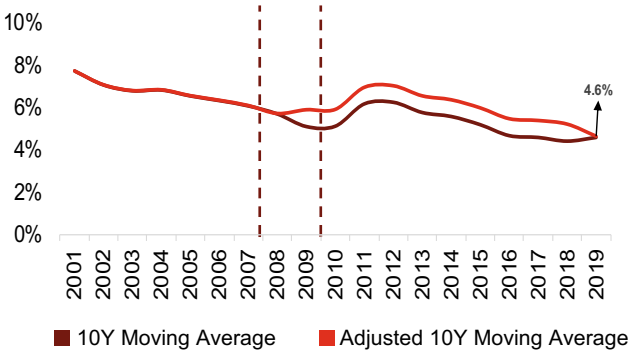
(2) 2021 was a normalization period,

(3) 2022 witnessed high electricity prices.

The 10-year MA demand growth curve indicates that electricity demand in Türkiye has started to shift from high growth towards average growth.

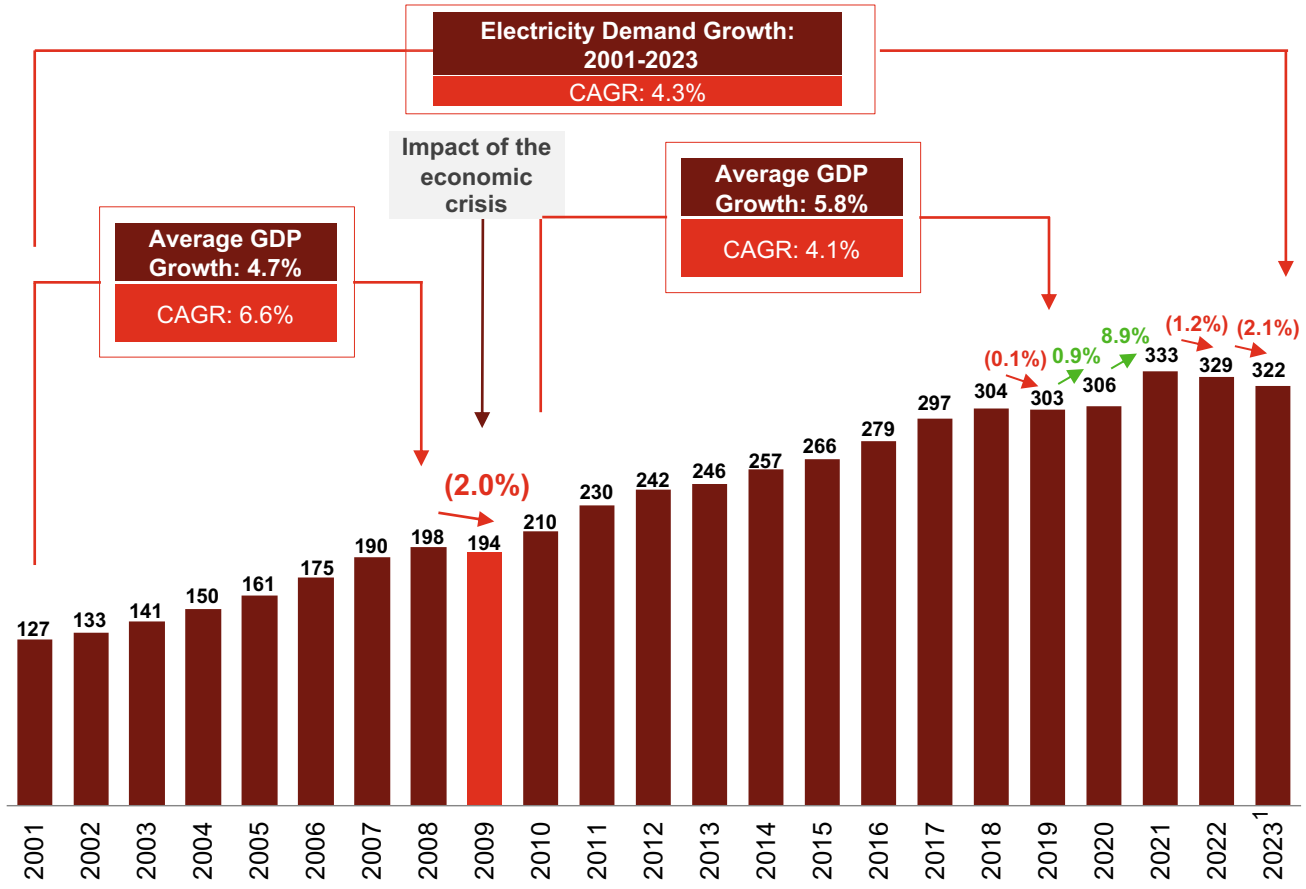
Graph 10

10Y Moving Average Growth of Electricity Demand (2001-2019, %)



Graph 11

Historical Electricity Demand (2001-2023[1], TWh)



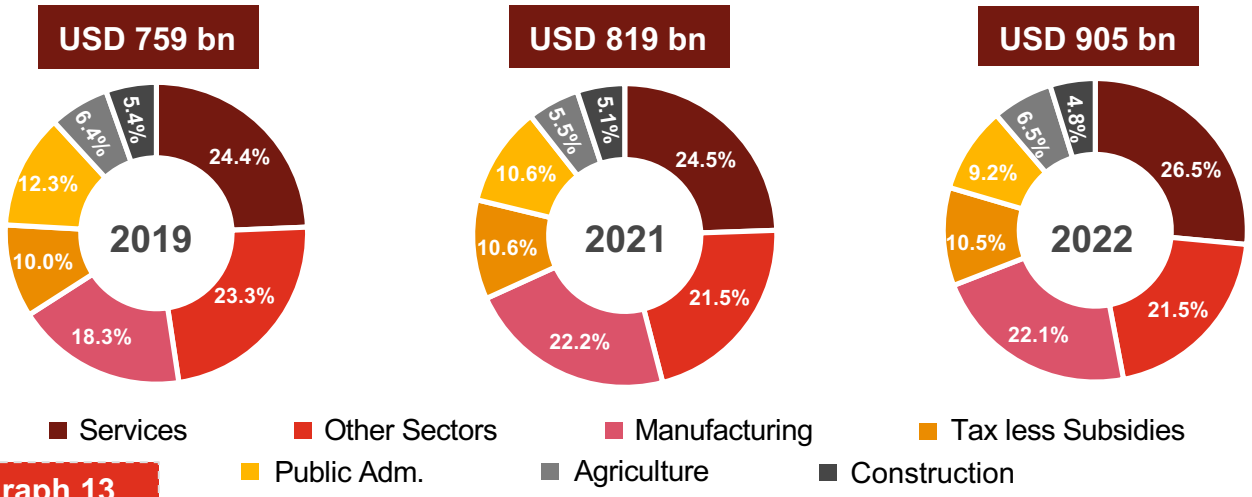
[1]Adjusted to LTM as of June 2023

Source: EPİAŞ, MENR

Türkiye's electricity demand experienced a limited decrease in 2022, total consumption remained around 330 TWh.

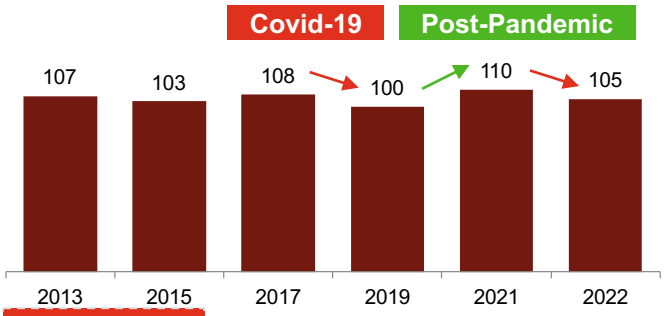
Graph 12

Total GDP (USD, Nominal) **Breakdown by Sector** (%)



Graph 13

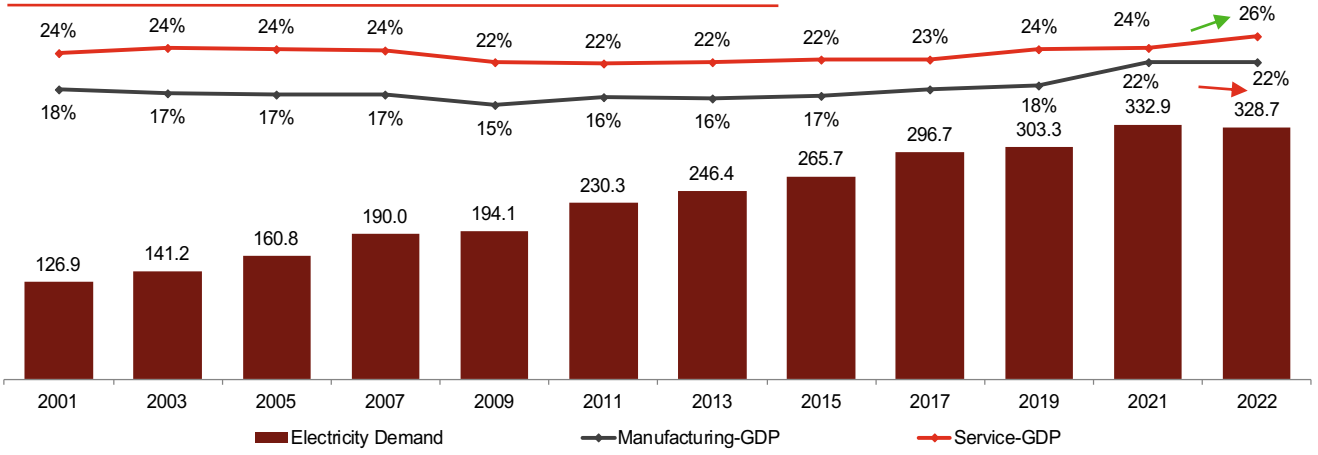
Manufacturing Sector Confidence Index (2007-2022)



Türkiye's GDP increased by 11% and 5% on real terms in 2021 and 2022. The decrease in share of government spending was most visible and the largest contributor to GDP came from services sector in 2022. The share of manufacturing in GDP increased to 22% in 2021 from around 18% in 2019, and remained stable in 2022. The partial decrease in electricity consumption for 2022 can be attributed to stagnant economic share of manufacturing in GDP at the hand of increasing services activity, to a certain extent.

Graph 14

Electricty Demand and the share of Manufacturing and Service Sectors in GDP, (2001-2022, 2020 excluded, TWh)



[1] Other industries includes: Mining, Electricity and Gas Supply, Water Supply

Source: TEİAŞ, TUIK, MENR

The correlation between electricity demand and GDP is attributable to industrial production demand, which can be observed particularly during economic recessions. Share of industrial demand peaked in 2021 due to rebound impact after covid slowdown experienced in 2020.

Energy consumption in developing countries that import primary energy sources directly affects gross domestic product (GDP). Türkiye imports **99%** of its natural gas supply from Russia, Azerbaijan and other countries. Therefore, the average marginal cost of electricity generation in the country is directly linked to the prices and volume of imported fuel sources.

Industrial productivity may slow down due to fluctuations in price or changes in the supply security of imported energy sources due to their impact on electricity prices. This leads to a direct correlation between industry development and economic growth.

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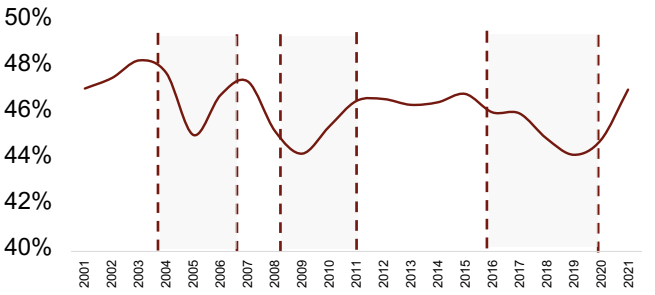
Graph 15

Share of Industrial Demand, (2001-2021)



Share of industrial demand illustrated a huge increase in 2021 with the impact of post Covid-19 pick-up in economic activity. The increased share of industrial demand put consumption at an all-time high 333 TWh in 2021.

Table 1

Electricity Demand and Real GDP Growth, (2019-2022)

%	2019	2020	2021	2022
Electricity Demand Growth	-0.3%	0.9%	8.7%	-1.2%
Real GDP Growth	0.8%	1.9%	11.4%	5.6%

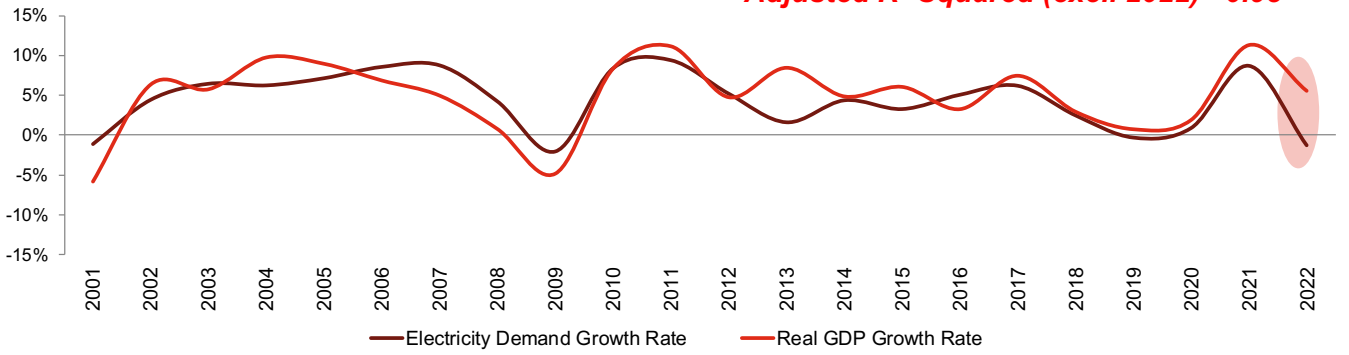
- Before 2021-2022 period, the GDP growth was mostly driven by the manufacturing sector. However, in 2022, 5.6% increase in the GDP was driven by the services sector which led to a slight decrease in electricity consumption.

Graph 16

Correlation Between Electricity Demand and Real GDP Growth, (2001-2022)

Adjusted R- Squared (incl. 2022)= 0.97

Adjusted R- Squared (excl. 2022)= 0.98



Source: TEİAŞ, IMF, MENR

Net Electricity Demand

284 TWh	=	305 TWh	+	30 TWh	-	1.8 TWh	-	46 TWh	-	2 TWh
85.1%[1]		91.1%[1]		8.9%[1]		0.5%[1]		13.7%[1]		0.6%[1]
Net Demand (2021)		EÜAŞ & IPP Generation		Autoproducers		Net Imports / (Exports)		Transmission Losses & Internal Consumption		Oil Refineries

Gross Demand = 335 TWh (2021)

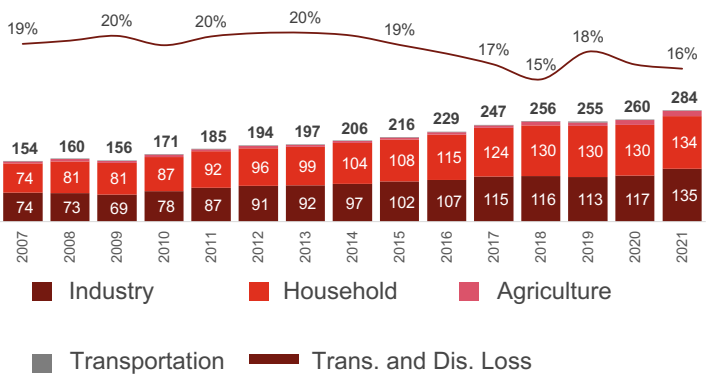
[1] As a Percentage of Gross Demand

Net demand in Türkiye comes mostly from industrial production, which increased significantly and accounted for 47.5% of total demand in 2021, due to post Covid impact related to delayed demand in industrial goods.

The demand for the transportation and agriculture sectors maintained the same share of the energy balance throughout this period.

Graph 17

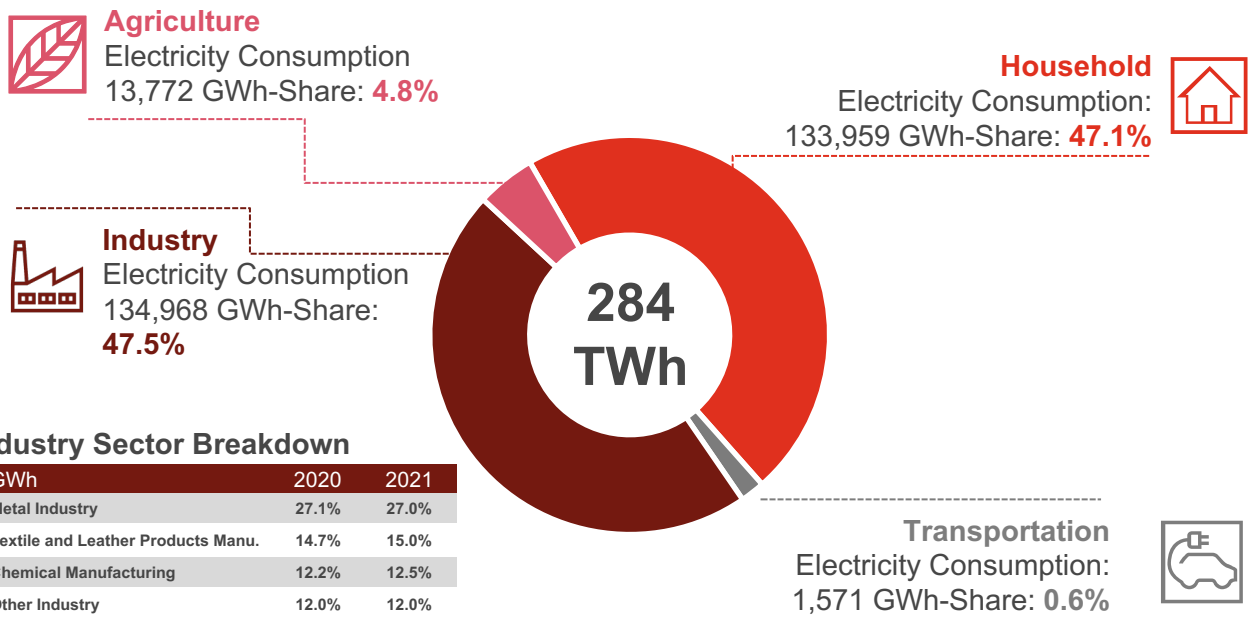
Net Demand By Sector (2007-2021, TWh)



[2]Prior to 2016, the households & services demand data was not published separately. For purposes of integrity, the net demand for these sectors were consolidated between 2016 to 2018.

Graph 18

Total Net Demand by Sector (2021)[1]



Industry Sector Breakdown

GWh	2020	2021
Metal Industry	27.1%	27.0%
Textile and Leather Products Manu.	14.7%	15.0%
Chemical Manufacturing	12.2%	12.5%
Other Industry	12.0%	12.0%
Non-Metalic Products Manu.	11.2%	10.8%
Food and Beverage	7.5%	7.3%
Others	15.3%	15.3%

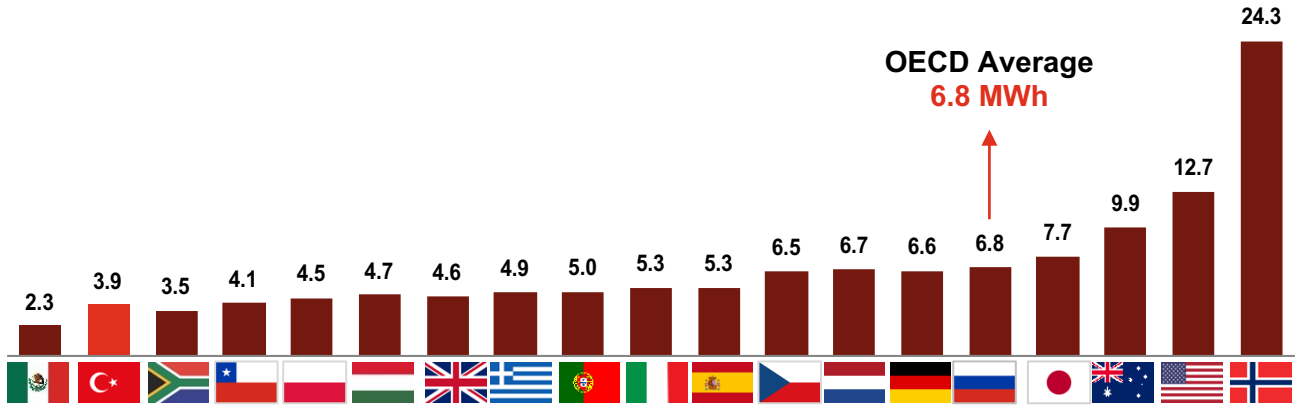
[1] The most recently published energy balance table has been used within the scope of this report.

Source: MENR

Türkiye's electricity demand per capita is below the OECD average. Türkiye's per capita demand figure has remained nearly the same since 2017 with a slight increase in 2021.

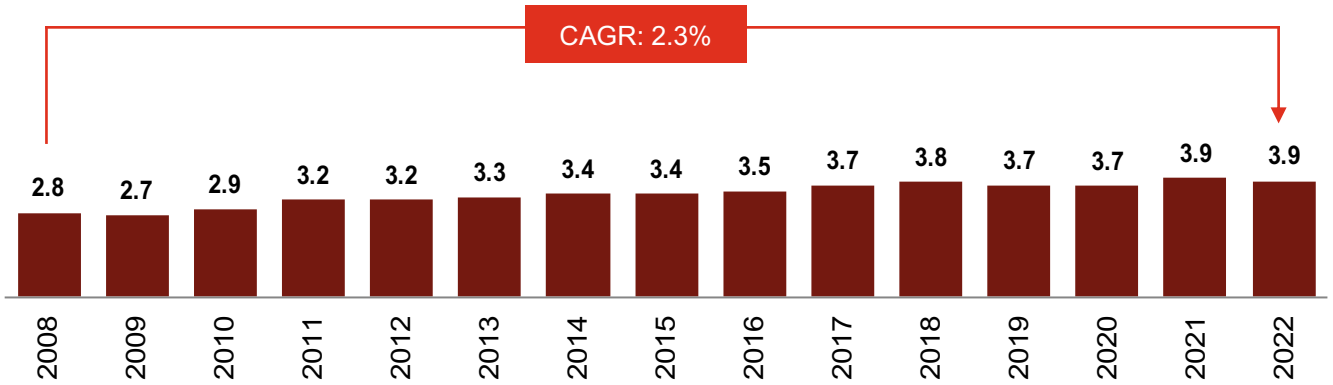
Graph 19

Per Capita Electricity Demand of Selected OECD Countries (2021, MWh)



Graph 20

Per Capita Electricity Demand of Türkiye (2008-2022, MWh)



Demand is supported by different blends in different countries.

Table 2

Electricity Demand Share by Sector (2020, %)

Country	Industry	Services	Household	Transportation	Agriculture	Other
	45%	27%	23%	1%	4%	0%
	52%	19%	25%	1%	3%	0%
	55%	10%	23%	0%	5%	7%
	40%	34%	22%	2%	1%	0%
	44%	20%	30%	3%	3%	0%
	30%	28%	38%	2%	1%	0%
	41%	25%	33%	0%	1%	0%
	44%	26%	26%	2%	1%	0%
	43%	27%	24%	4%	2%	0%

Source: IEA

TEİAŞ publishes a demand forecast report with three demand growth scenarios (low, base and high), combining forecast results from distribution companies and for licensed Organized Industrial Zones. The latest report was released in December 2021 and projects electricity demand in Türkiye for the following 10 years.

According to the Electricity Market Demand Forecasts Regulation, distribution companies are obliged to annually report 10-year electricity demand forecast for their distribution regions to MENR and TEİAŞ. Similar reporting obligations for 5-year periods apply to designated retail companies. TEİAŞ combines information from these reports with the information obtained from organized industrial zones to prepare the demand forecast.

The **electricity demand** in Türkiye for the 12 months of **2022** was **328.7 GWh**, which was **lower** than TEİAŞ's **high scenario demand forecast** but **slightly higher** than the **base scenario forecast** for **2022** (**340.8 GWh**).

Graph 21

Total Electricity Demand (GWh)

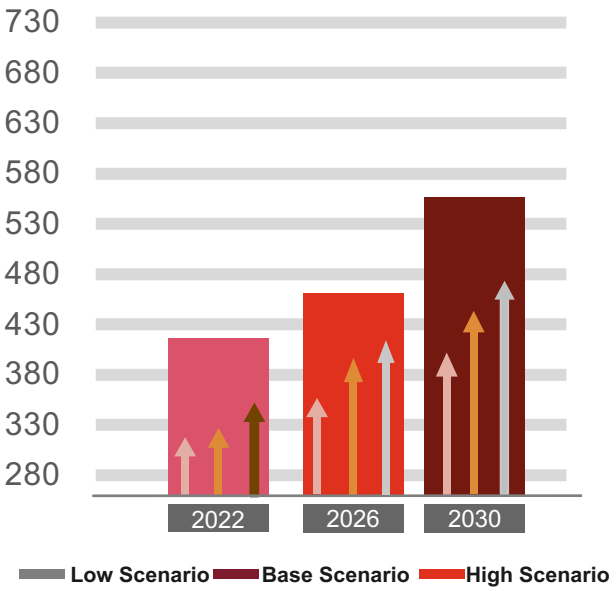


Table 3

TEİAŞ Electricity Demand Forecasts (2022-2031)

	Low Scenario		Base Scenario		High Scenario	
Year	Demand (GWh)	Growth Rate (%)	Demand (GWh)	Growth Rate (%)	Demand (GWh)	Growth Rate (%)
2022	308,903	3.1%	324,536	3.8%	340,810	7.9%
2023	317,755	2.9%	335,819	3.5%	354,446	4.0%
2024	329,911	3.8%	350,716	4.4%	371,927	4.9%
2025	344,265	4.4%	367,792	4.9%	391,806	5.3%
2026	357,757	3.9%	383,426	4.3%	409,551	4.5%
2027	369,703	3.3%	397,438	3.7%	425,790	4.0%
2028	378,902	2.5%	408,872	2.9%	439,739	3.3%
2029	389,682	2.8%	421,925	3.2%	455,387	3.6%
2030	400,825	2.9%	435,418	3.2%	471,572	3.6%
2031	415,042	3.5%	452,210	3.9%	491,224	4.2%

Source: TEİAŞ

Türkiye's observer membership status with ENTSO-E will facilitate cooperation between ENTSO-E and TEİAŞ.

Türkiye's Transmission System

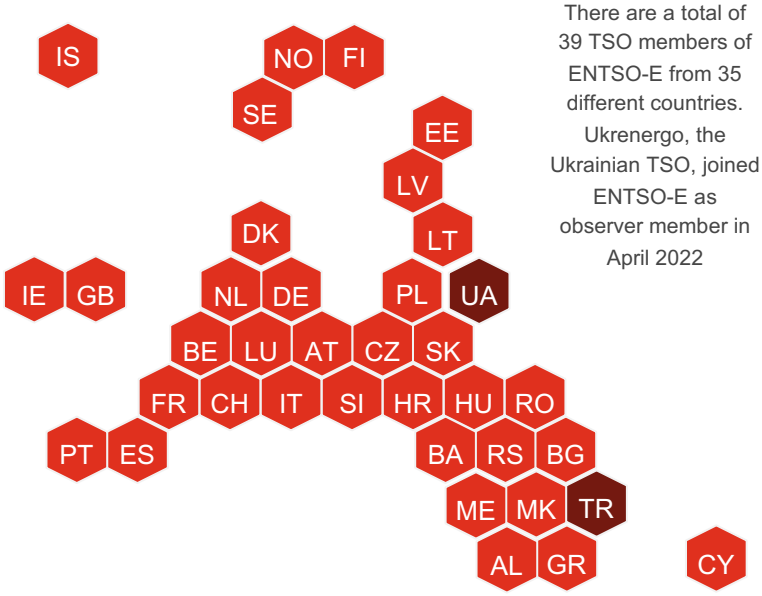
Capacity

As of June 2023, the total length of transmission lines in the country amounted to **73,806 km**, and there were **789** transformer centres. There are **15** interconnection lines with neighbouring countries.

Trade through Transmission System

As of 2023[1], **electricity exports** in Türkiye reached **2,647 GWh**, whereas total **electricity imports** amounted **7,012 GWh**. **Greece** constituted the highest share of electricity **exports** with **69.6%,** and **53.8%** of total electricity was **imported** from **Bulgaria** in 2022.

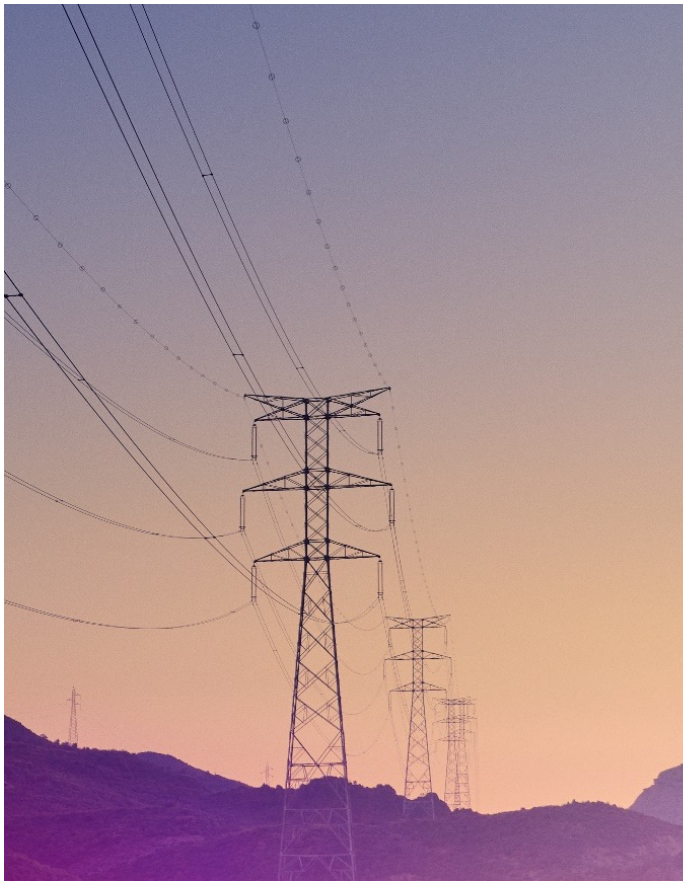
Country of Origin of the Transmission System Operators Members of the ENTSO-E



There are a total of 39 TSO members of ENTSO-E from 35 different countries. Ukrenergo, the Ukrainian TSO, joined ENTSO-E as observer member in April 2022

[1] Adjusted to LTM as of June 2023

Source: TEİAŞ

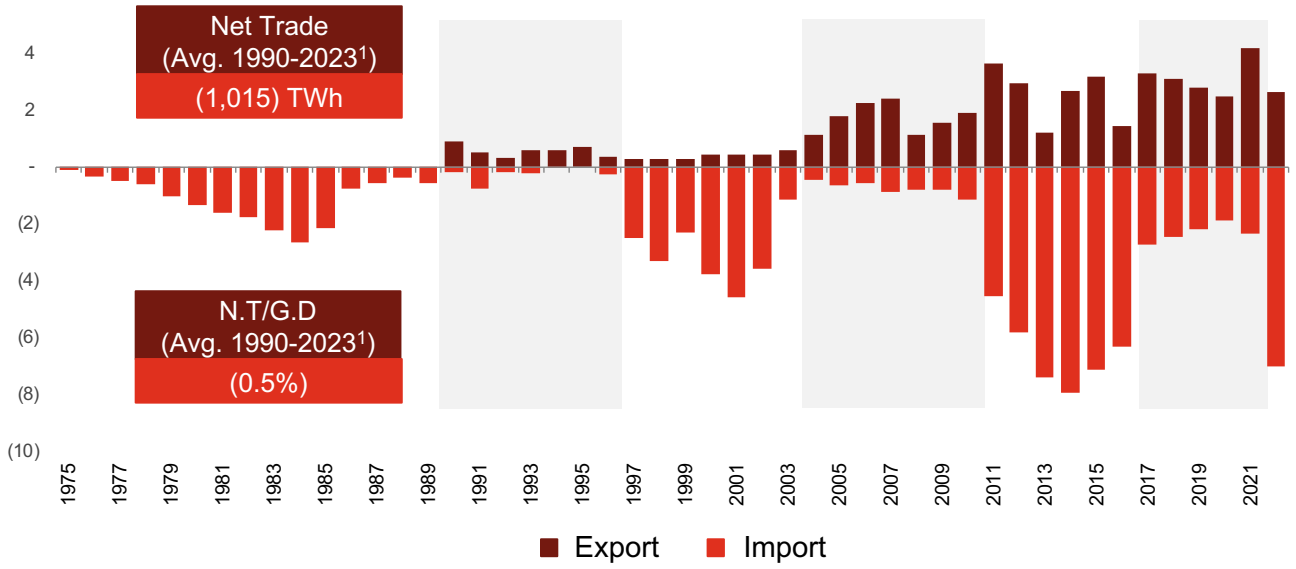


With the European Network of Transmission System Operators (ENTSO-E), Türkiye has developed a project to establish a connection between its national electricity system and the European electricity system. TEİAŞ became an observer member of ENTSO-E as of the beginning of 2016. The observer member status will give TEİAŞ the opportunity to attend groups and task forces within the association.

In 2023, Türkiye imported 7.01 TWh of electricity, exported 2.64 TWh, and realized a net electricity trade of (4.40) TWh. This was the first time Türkiye had been a net electricity importer since 2016. Still, net trade to gross demand ratio remained very limited.

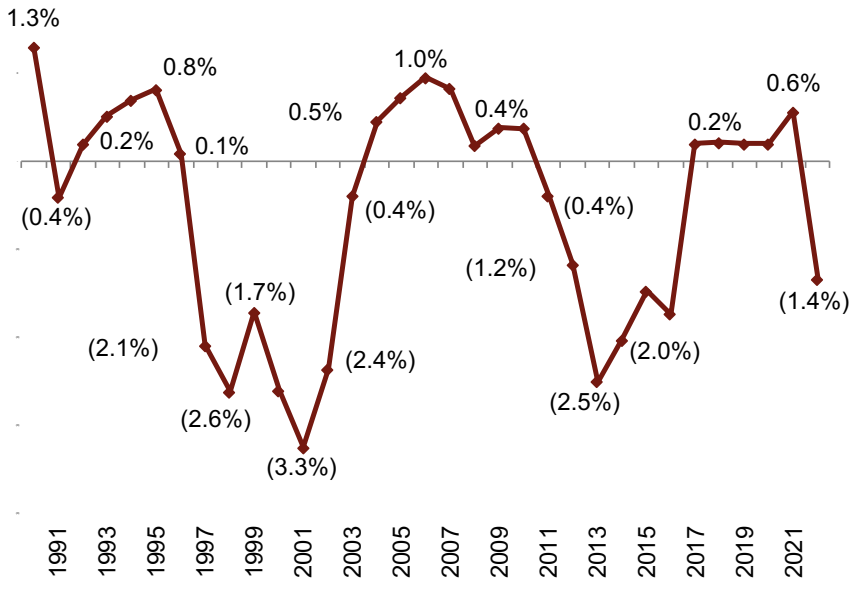
Graph 22

Türkiye's Electricity Export and Import Volume (TWh)



Graph 23

Net Trade to Gross Demand Ratio (%)



Export and Import Partners (2022)

Import – Top 3 Partners		
1		53.8%
2		45.4%
3		0.9%

Export – Top 3 Partners		
1		69.6%
2		15.3%
3		6.2%

[1] Adjusted to LTM as of June 2023

Source: TEİAŞ, TUİK

Prior to 2004, the distribution network in Türkiye was operated by TEDAŞ, a state-owned monopoly. Following government policy directed towards privatization, the distribution network was split into 21 regions controlled by private market players.

The privatization of the distribution sector concluded in 2013. The sector is controlled by 21 distribution companies that are active in their related regions and are responsible for the following.

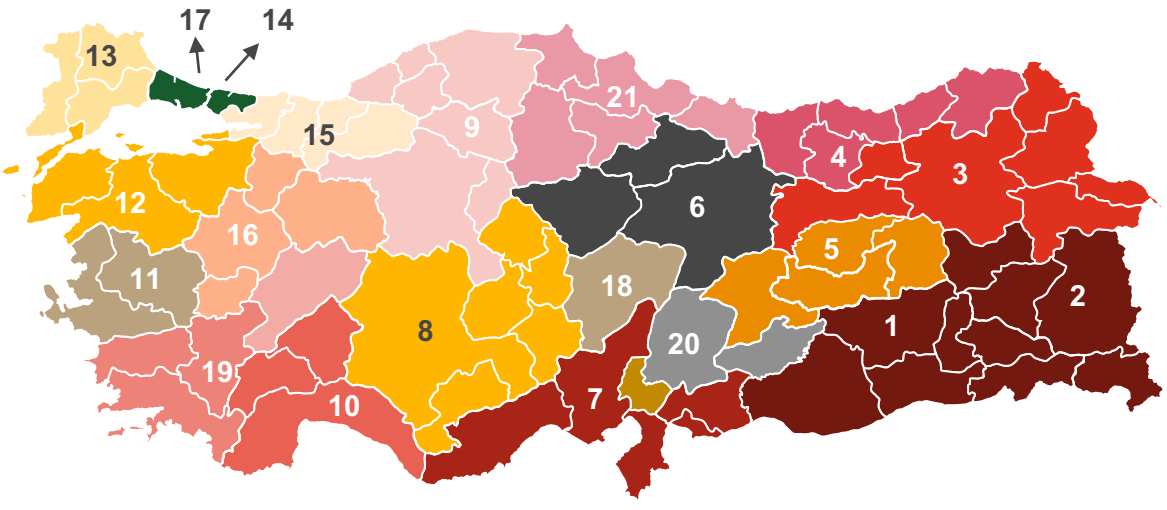
- Maintenance of the local distribution network,
- Development of the distribution network,
- Collecting metering data and engaging in the billing process,
- Forecasting electricity demand of the region.

Local and foreign investors, some of whom were already engaged in electricity generation, participated in the privatization process. After the unbundling of distribution and retail activities, private distribution companies now also have separate retail arms and the right to engage in retail electricity sales in their regions.

Table 4

List of Distribution Regions

Region	DSO Name	Operating Firms
1	Dicle Edaş	Eksim
2	Vedaş	Türkerler
3	Aras Edaş	Çalık-Kiler
4	Çoruh Edaş	Aksa
5	Fırat Edaş	Aksa
6	Çedaş	Kolin-Cengiz
7	Toroslar Edaş	EnerjiSA
8	Medaş	Alarko-Cengiz
9	Başkent Edaş	EnerjiSA
10	Akdeniz Edaş	Kolin-Cengiz
11	Gdz	Aydem
12	Uedaş	Limak
13	Tredaş	Ic Içtaş
14	Ayedaş	EnerjiSA
15	Sedaş	Akenerji-CEZ
16	Oedaş	Zorlu
17	Bedaş	Kolin-Cengiz
18	Kcetaş	Kayseri Municipality
19	Adm	Aydem
20	Akedaş	Kipaş
21	Yedaş	Çalık



Source: TEİAŞ

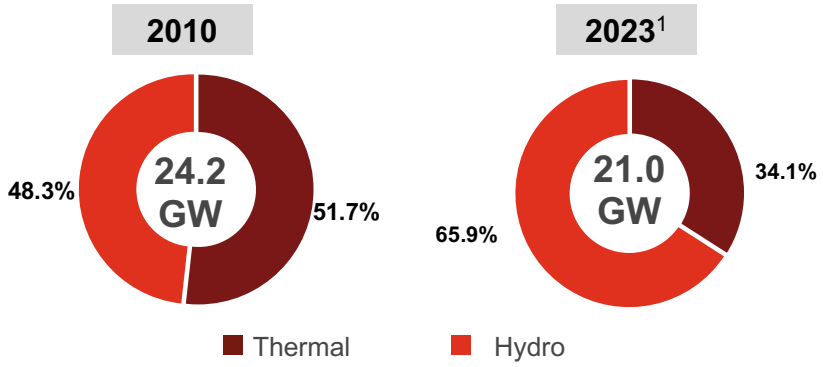
3

Electricity Generation Analysis

EÜAŞ is the largest market player in the generation sphere.
The installed capacity of EÜAŞ-owned facilities increased significantly between 1970 and 1990. The last 20 years saw the share of EÜAŞ-owned capacity in the market decrease due to emerging IPPS and privatizations.

Graph 24

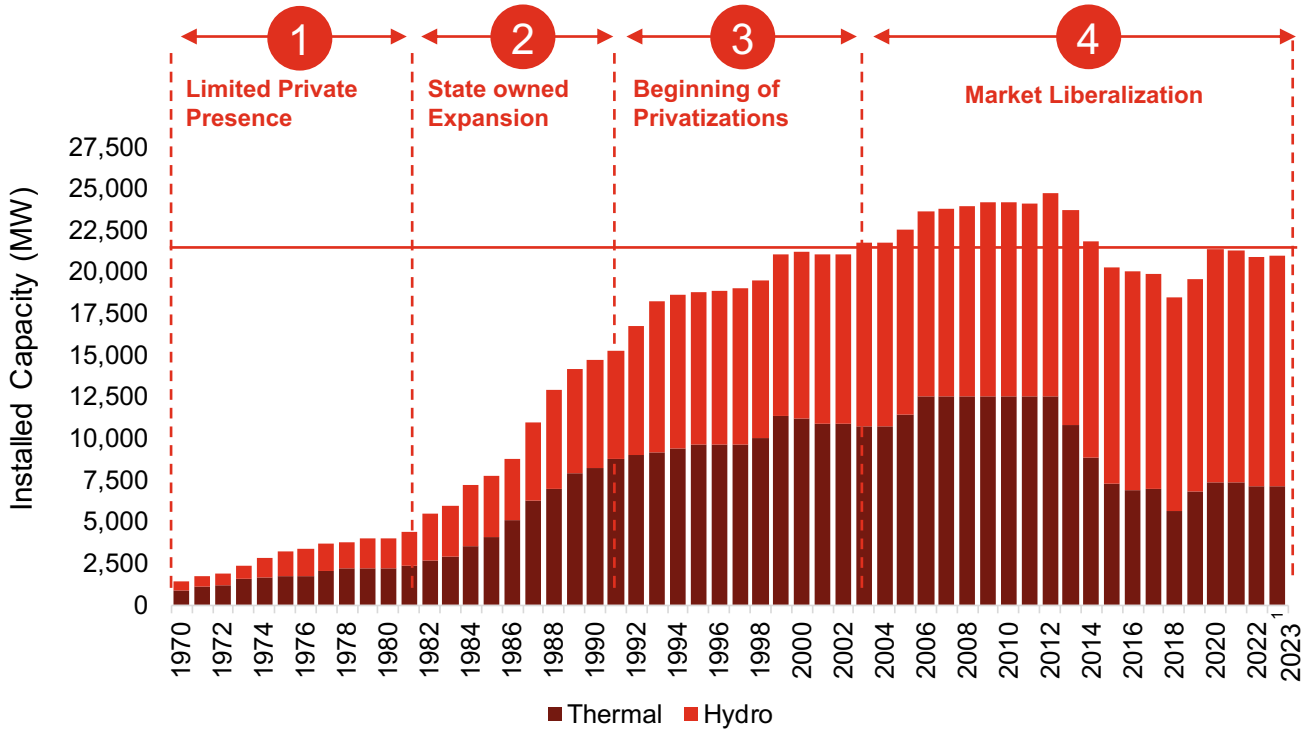
Installed Capacity Of EÜAŞ by Energy Source (%)



The total installed capacity of EÜAŞ decreased from 24.2 GW in 2010 to 21.0 GW as of June 2023. This was mainly due to large scale privatizations in the last 10 years. The share of EÜAŞ-owned capacity in the market decreased from 48.9% in 2010 to 20.0% in June 2023.

Graph 25

Installed Capacity of EÜAŞ (1970-2023)



[1] Data as of June 2023

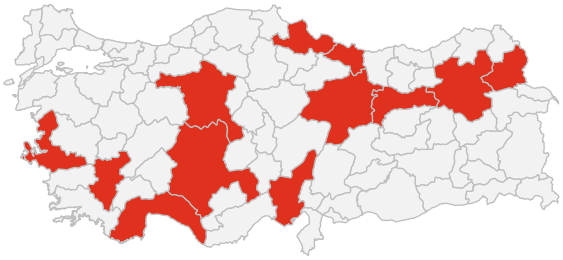
Source: EÜAŞ, TEİAŞ

There are several small and large HPPs owned by EÜAŞ awaiting privatization.

Table 5

Privatization Project Pipeline - HPPs

Facility Name	Capacity (MW)	City
Kesikköprü HPP	76.0	Ankara
Demirköprü HPP	69.0	İzmir
Seyhan 1 HPP	60.0	Adana
Derbent HPP	56.0	Samsun
Çamlıgöze HPP	32.0	Sivas
Kepez 1 HPP	26.4	Antalya
Seyhan 2 HPP	8.0	Adana
Yüreğir HPP	6.0	Adana
Kepez 2 HPP	6.0	Antalya
Dereiçi HPP	0.4	Kars
Koyulhisar HPP	0.2	Sivas
Total	**340.0**	



*There are several hydropower plants currently awaiting the privatization process. These HPPs have an installed capacity of **340.0 MW** in total.*

Largest EÜAŞ Owned Hydropower Plants

2,405 MW Atatürk HPP

702 MW Altınkaya HPP

1,800 MW Karakaya HPP

672 MW Birecik-Nizip HPP

1,330 MW Keban HPP

670 MW Deriner HPP

1,208 MW Ilısu HPP

510 MW Berke HPP

558 MW Yusufeli HPP

Table 6

Natural Gas Power Plants of EUAS

Bursa Natural Gas
1,432 MW Capacity

Istanbul Natural Gas A&B
1,350+816 MW Capacity

Esenyurt Natural Gas
180 MW Capacity

Tekirdağ Natural Gas Combined Cycle A&B
480+478 MW Capacity

Tekirdağ Natural Gas Combined Cycle Power Plant A&B (overall installed capacity of 958MWe) facilities belonging to EÜAŞ has also been included in the scope of privatization. Privatization procedures are expected to be completed until 31 December 2025.

Table 7

Completed Privatizations in 2021&2022

Facility Name	Capacity (MW)	Complete Date	City	Price (m TL)
Ahiköy 1 & 2 HPP	4.4	2021	Sivas	11
Camlica 1 HPP	84.0	2021	Kayseri	581
Tortum HPP	26.2	2021	Erzurum	223
Topçam HPP	60.3	2021	Ordu	925
Çal HPP	2.5	2022	Denizli	9
Girlevik 2-Mercan HI	11.6	2022	Erzincan	136
Total	**189.0**			**1884**

Source: Directorate of Privatization Administration, EÜAŞ

Turkish Electricity Transmission Corporation (TEİAŞ) was included in the scope of the country's privatization process, published in Türkiye's Official Gazette on 4 July 2021. As announced by Directorate of Privatization Administration, the deadline for the privatization through IPO of TEİAŞ was extended to 31 December 2024.

Table 8

TEİAŞ Operational Metrics

Transmission Line Length (2023)
As of June 2023, TEİAŞ reached **73,806** kilometers of energy transmission lines.

Transmission Agreements (2022)
TEİAŞ has signed new **249** electricity connection agreements in **2022**. (**51** generation, **49** eligible consumer and **149** distribution licensee companies)

Number of Transformers (2022)
TEİAŞ owns **2,096 transformers** and **217,571 (MVA) of installed capacity.**

Capital Expenditures (2022)
TEİAŞ executed **632** investment and improvement projects in 2022. Total spendings for these projects amount to approximately **USD 2 bn.**

By offering the minority share of TEİAŞ to the public, it is expected that a broader investor base will be brought to the company ecosystem, while State remains to be largest shareholder and sustain its operational control over TEİAŞ.

All over the globe, there are multiple publicly traded TSOs (Transmission System Operators).

Table 9

Comparable Transmission Companies and Valuation Multiples

Company Name	Country	Line Length (km)[1]	Market Cap (m USD)[2]	Enterprise Value (m USD)	FY22 Gross PPE (m USD)	FY22 Net PPE (m USD)	EV/GPPE (x) [3]	EV/NPPE (x) [3]
Eversource Energy	US	3,701	29,531	49,850	46,043	36,170	1.1	1.4
Power Grid Corporation of India	India	174,601	19,370	35,015	35,981	26,729	1.0	1.3
Hydro One Limited	Canada	30,000	15,772	26,643	28,449	18,570	0.9	1.4
Terna	Italy	74,855	15,283	24,360	28,517	17,314	0.9	1.4
Red Eléctrica Corporación	Spain	45,000	10,155	13,952	19,630	10,288	0.7	1.4
Hawaiian Electric Industries	US	4,828	4,445	5,353	8,995	5,803	0.6	0.9
Synergy Grid & Development Phils	Philippines	n.a.	1,188	4,908	251	91	n.m.	n.m.
Chongqing Fuling Electric Power	China	n.a.	1,750	1,455	1,335	527	1.1	2.8
Kazakhstan Electricity Grid Operating	Kazakhstan	26,977	944	1,089	3,746	1,857	0.3	0.6
Litgrid AB	Lithuania	7,245	399	448	474	393	0.9	1.1
CNTEE Transelectrica SA	Romania	9,000	303	262	1,145	883	0.2	0.3
Transener	Argentina	12,400	258	228	1,163	500	0.2	0.5
Average							**0.7**	**1.2**
Max							**1.1**	**2.8**
Min							**0.2**	**0.3**

TEİAŞ recorded approximately **USD 1.4 bn net sales** in 2022.

[1]Figures provided above are latest Transmission Line Length (km) of selected comparable companies. Transmission Line Length measurements are obtained from companies' own websites and mostly based on company's approximations.
[2]Market caps of the companies are calculated as the average of the values occurred between 01.01.2022 and 31.12.2022
[3]n.m. refers to not meaningful EV multiples (below 0x or above 10x).

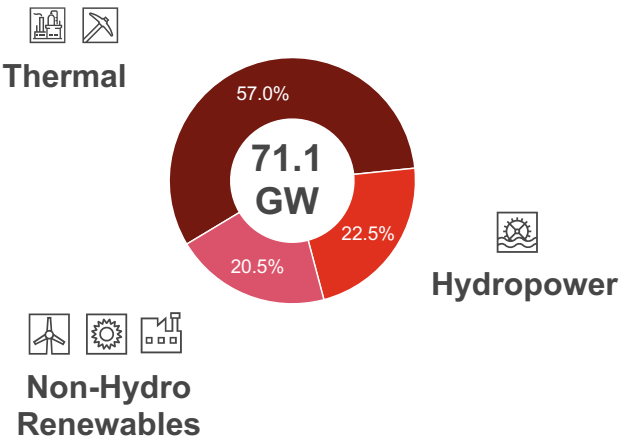
Source: Directorate of Privatization Administration, Publicly Available Sources (April 2023),TEİAŞ, Capital IQ

The share of state-owned installed capacity has been shrinking since the early 2000s due to the increase of investments by IPPs as well as large scale privatizations.

IPPs had a 67.8% share of the total installed capacity of Türkiye in June 2023 which was mainly made up of a mixture of thermal, non-hydro and hydro renewables. The increase in installed capacity of IPPs in recent years is mainly due to the increase of hydro and natural gas power plants.

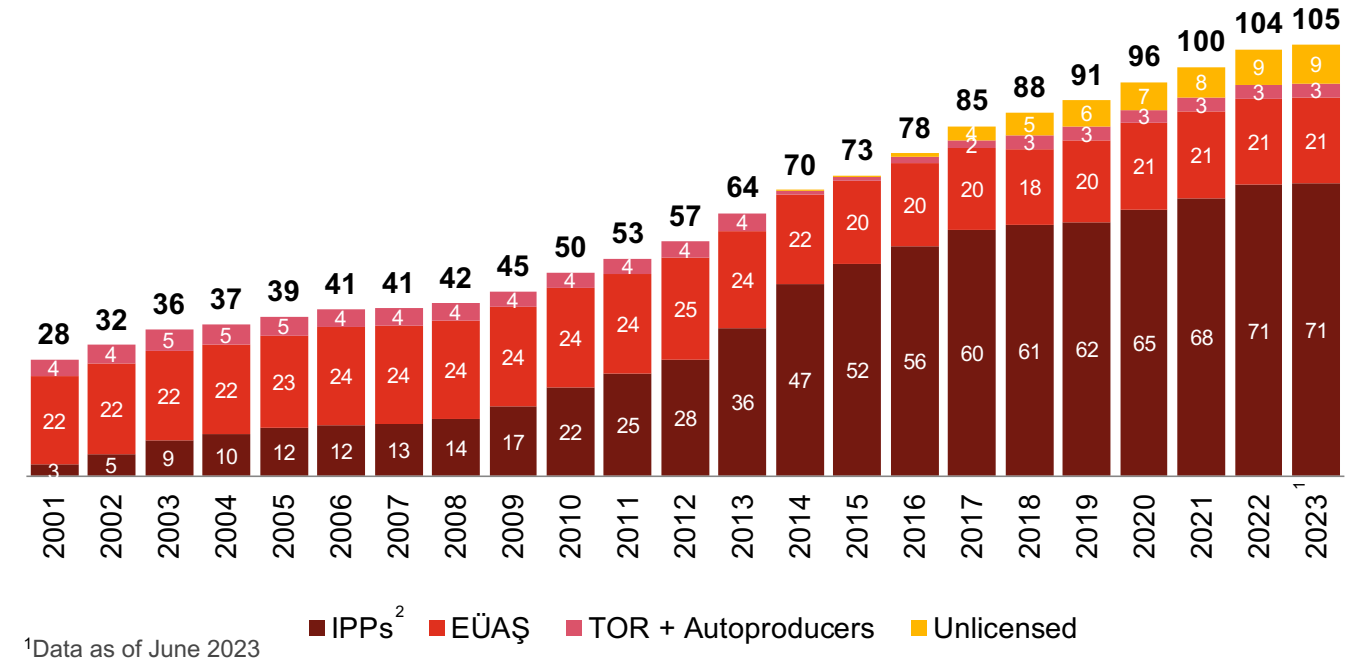
Graph 26

Installed Capacity Breakdown of IPPs, (June 2023)



Graph 27

Installed Capacity Share by Ownership Sources, (2001-2023, GW)[3]



[1]Data as of June 2023

[2]The share of the private companies prior to 2006 are BOT agreements signed with private companies under concession agreements.

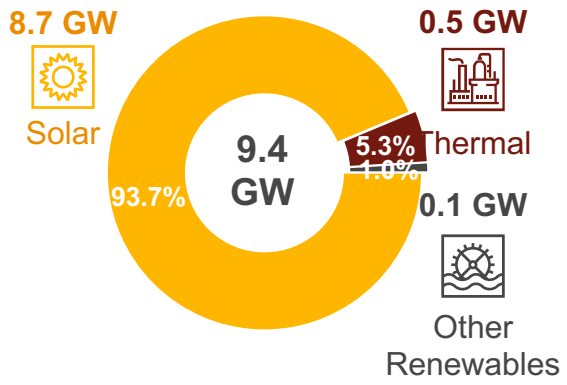
[3] The figures announced in the TEİAŞ monthly reports, based on the installed capacity of currently operating power plants.

Source: TEİAŞ

Unlicensed capacity increased, particularly through solar investments. 2019 regulations replacing FiT with active energy cost curbed investors' appetite for unlicensed facilities. The unlicensed installed capacity increases starting from 2021 stem from promotion of self consumption.

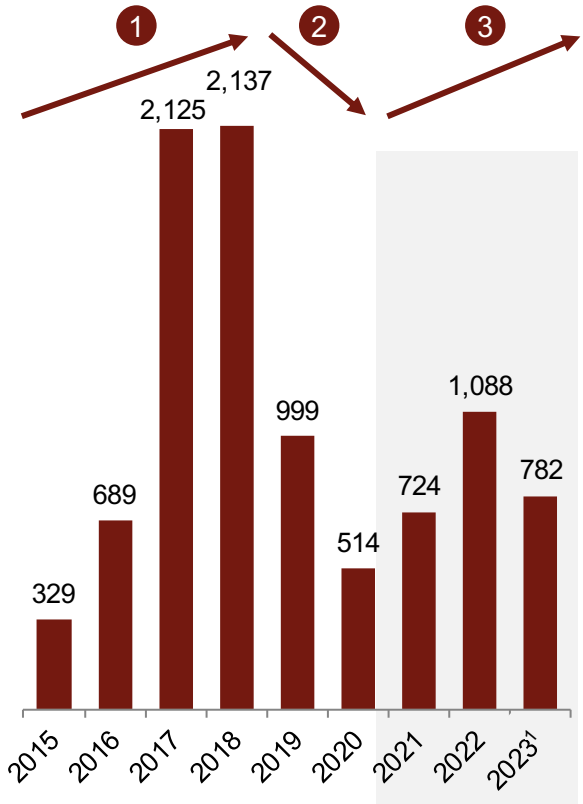
Graph 28

Unlicensed Installed Capacity (June 2023)



Graph 29

Development of Unlicensed Installed Capacity



[1]Data as of June 2023

Source: TEİAŞ

The total installed capacity of the unlicensed power plants increased significantly over the last couple of years, from around **0.4 GW** by the end of 2015 to as high as **9.4 GW** by June 2023. As of June 2023, 93.7 % of the unlicensed capacity in Türkiye comes from solar energy, whereas other renewables have lagged significantly behind. There are several key factors attributable to the high amount of unlicensed solar energy in Türkiye:

1. Efficiency is not driven by scale
2. Panel costs decreasing over time
3. Türkiye's solar energy potential
4. Operational simplicity compared to other technologies

1	2	3
Advancements in the technology, positive effect of YEKDEM FiT	Negative effect of regulation change in 2019	Promotion of unlicensed plants for self consumption

Latest Changes in Regulation on Unlicensed Energy Generation

In **May 2019**, regulation change dictated that plants which received their call letter after May 12, 2019 can only benefit from active energy cost, not lucrative YEKDEM FiT (previous version restored with a new on in May 2023).

Change in **December 2020** introduced the way for unlicensed facilities to continue to sell excess electricity after the end of the FiT, as long as they continue to pay a license fee, which will be equal to 15% their production valued at DAMP.

Latest change in the regulation was implemented in **August 2022** and once again covers the plants which received their call letters after May 12, 2019. The change states that those plants can only sell as much electricity as the amount that is self-consumed. The amount exceeding the twice of self-consumption level, will be collected as a contribution for YEKDEM.

Due to multiple changes made to the regulatory framework in the recent years, landscape regarding unlicensed energy generation transformed significantly.

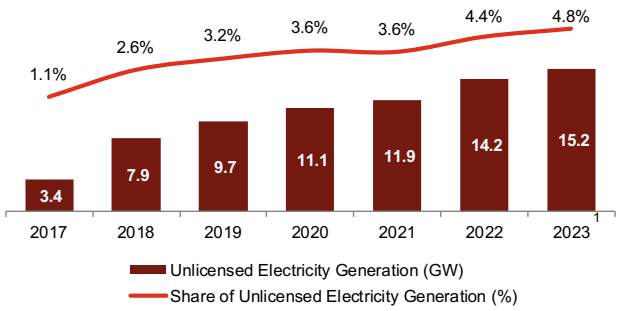
Pre-2019 Landscape	Landscape in 2019-2022	Landscape after mid 2022
• No limit on electricity sold to the national grid • Is eligible for YEKDEM FiT • Can benefit from local component incentive included in YEKDEM and regional investment incentives	• No limit on electricity sold to the national grid • Is not eligible for YEKDEM FiT • Can only benefit regional investment incentives	• Can only sell to the grid as much as the internal consumption level • Is not eligible for YEKDEM FiT • Can benefit from the 4th region incentives such as VAT and import tax exemption

Details Regarding the Latest Regulation on Unlicensed Energy Generation:

1. The amount of self-consumed electricity has been defined as the level of total consumption occurred in the previous calendar year. If no consumption has been made in the prior year, monthly average consumptions in the current year will be annualized.
2. It has been stated that if the realized self-consumption level in the current year exceeds the previous year's level or annualized level, the amount that can be sold will be updated as the realized self-consumption level in the current year.
3. Plants whose capacity do not exceed 50 kW and residential plants are considered to be exempt from the above explained limit applied on the electricity to be produced.
4. Regarding the plants generating energy for needs of facilities located in an organized industrial zone, the requirement which dictated that the plant should be located within the organized industrial zone has been revoked.

Graph 30

Share of Unlicensed Electricity Generation on Total Generation (2016-2023, TWh, %)



The share of unlicensed generation remained relatively stable after 2022 due to increase in autoconsumption. However, depending on the trends in regulatory framework, the share of unlicensed generation is expected to change.

Allocation of New Unlicensed Capacity by TEİAŞ

In March 2022, EMRA announced that unrealized capacities from cancelled YEKA tenders and earlier pre-YEKA WPP projects will be made available for unlicensed plants, hybrid plants and capacity increase for existing plants. Capacity allocations made for unlicensed power plants:

2022 – **594 MW**

2023 – **2,300 MW** [2]

[1] LTM of June 2023
[2] As of June 2023

Source: TEİAŞ, Official Gazette, Publicly Available Sources

Total installed capacity has expanded and diversified rapidly in the last decade, especially through the expansion of renewable energy sources since 2014.

Türkiye's installed capacity mix diversified and grew considerably with the introduction of new, non-hydro, renewable sources such as **wind, solar and geothermal energy**, and the expansion of existing sources such as **natural gas** and **imported coal**. Total installed capacity in Türkiye grew significantly between 2001 and 2023 with a **CAGR of 6.1%**, reaching **104.9 GW, up from 28.3 GW.**

Renewable and natural gas investments between 2009 and 2014 started generating electricity between 2013 and 2017, which led to a period of rapid growth of market supply.

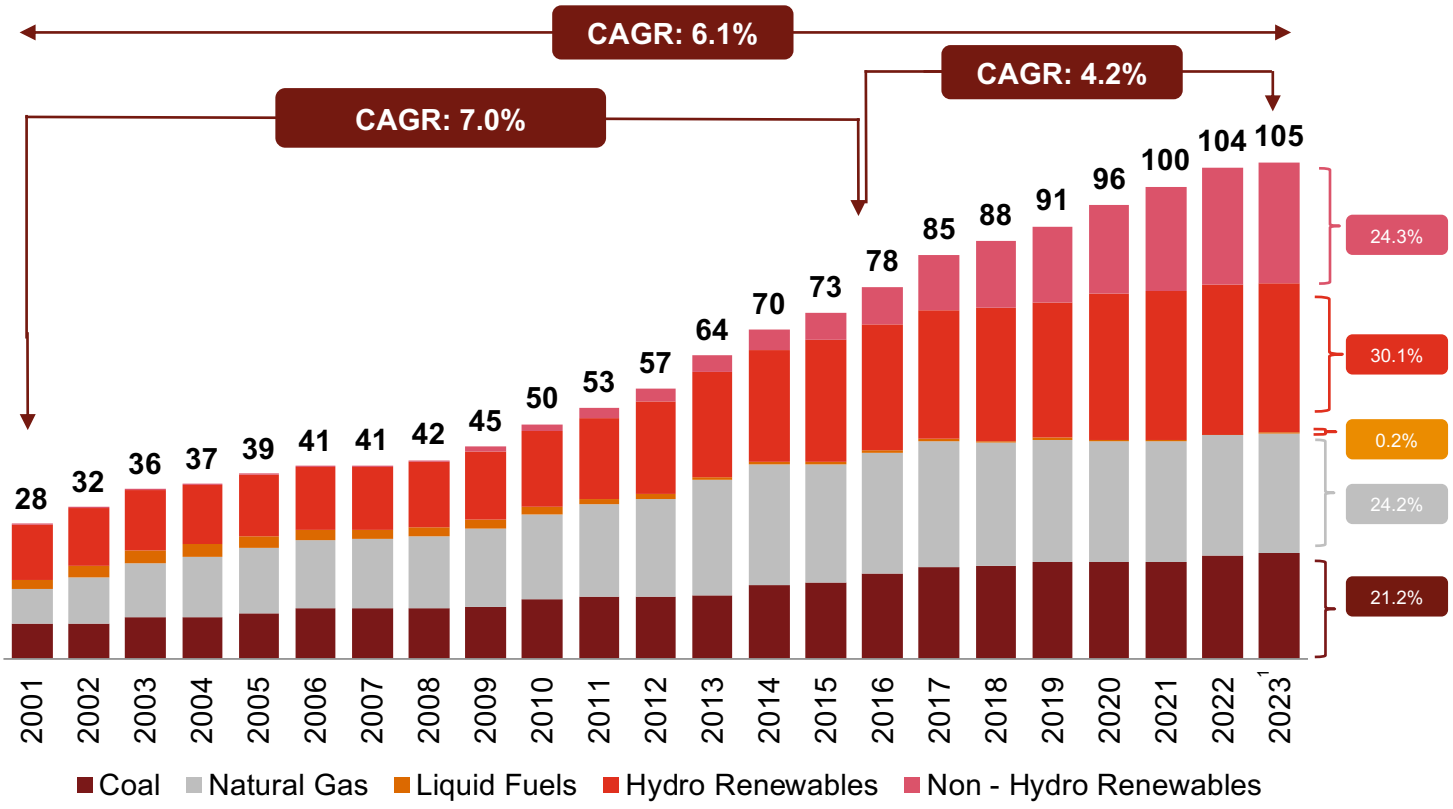
Following the drop of market prices in 2015, new projects were deemed less feasible and the profitability of existing power plants based on thermal sources decreased.

From 2018 to 2023, the net increase in thermal capacity was 1.9 GW. Major projects are as follows:

- Emba Hunutlu (imported coal) TPP is a 1.3 GW coal fired power station in Türkiye in Adana and started operations in 2022.
- Soma Kolin TPP (domestic lignite) is an installed capacity of 0.5 GW and started operations in 2019.
- Çan2 TPP (domestic lignite) is an installed capacity of 0.3 GW lignite coal and started operations in 2018

Graph 31

Installed Capacity by Energy Source (2001-2023[1], GW)



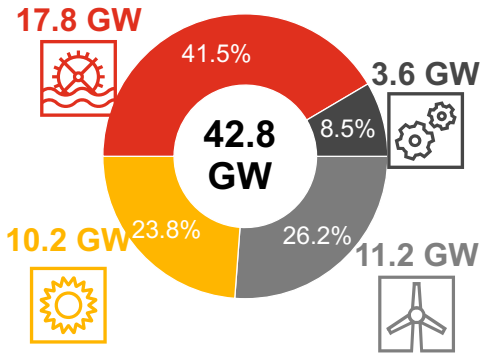
[1]Data as of June 2023

Source: TEİAŞ

Türkiye has been increasing its renewable installed capacity by around 15 GW in every four years period since 2008. Thermal capacity did not increase materially in the last four years.

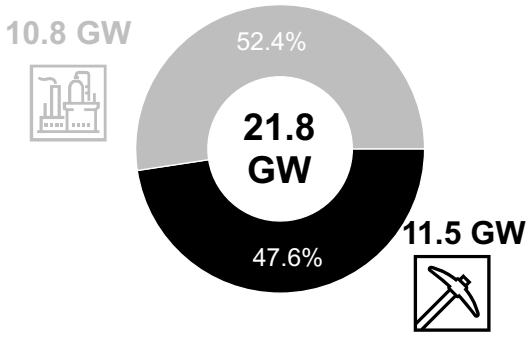
Graph 32

Additions in Renewable Installed Capacity (2009-2023[1])



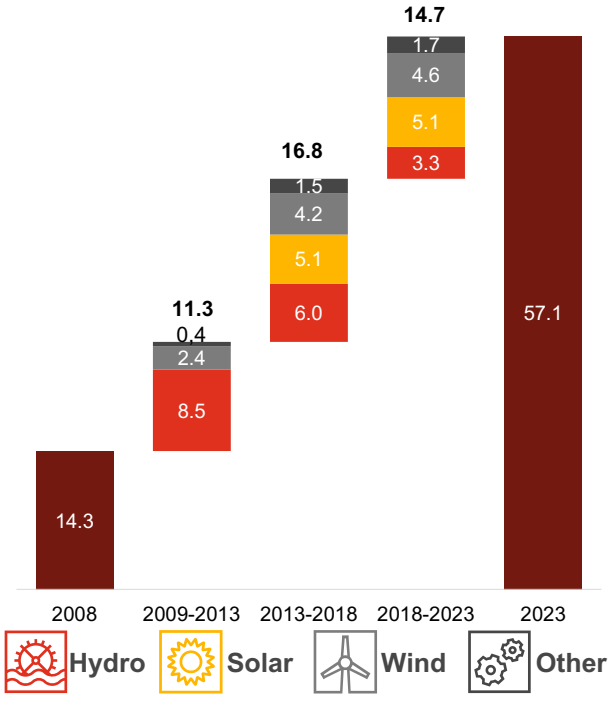
Graph 33

Additions in Thermal Installed Capacity (2009-2023[1])[2]



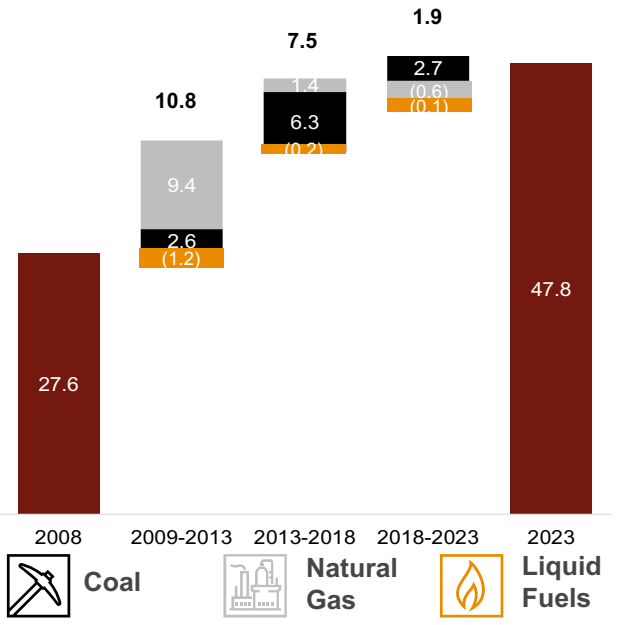
Graph 34

Breakdown of Increases in Renewable Installed Capacity (2009-2023[1], GW)



Graph 35

Breakdown of Increases in Thermal Installed Capacity (2009-2023[1], GW)



[1]Data as of June 2023

[2] The numbers above represent the gross additions to installed capacity. The net increase is measured as 20.2 GW. This difference is due to the decreases in the installed capacity and liquid fuel (2.1 GW) power plants.

Source: EMRA

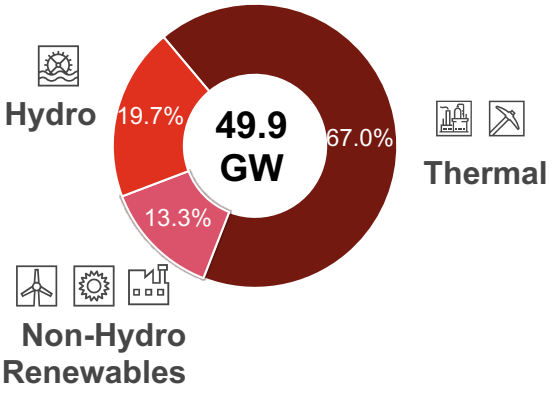
There are currently 17 independent power producers in the electricity generation market that have an installed capacity exceeding 1 GW.

Although the mix of installed capacity has changed significantly since **2014**, the largest source of installed capacity for many of the largest companies continues to be coal and natural gas.

The largest IPPs of Türkiye, illustrated below, accounted for a total of **49.9 GW** of installed capacity in **2023**, which is roughly **47.8%** of total installed capacity. **67.0%** of the installed capacity of **the largest IPPs** is related to thermal energy sources.

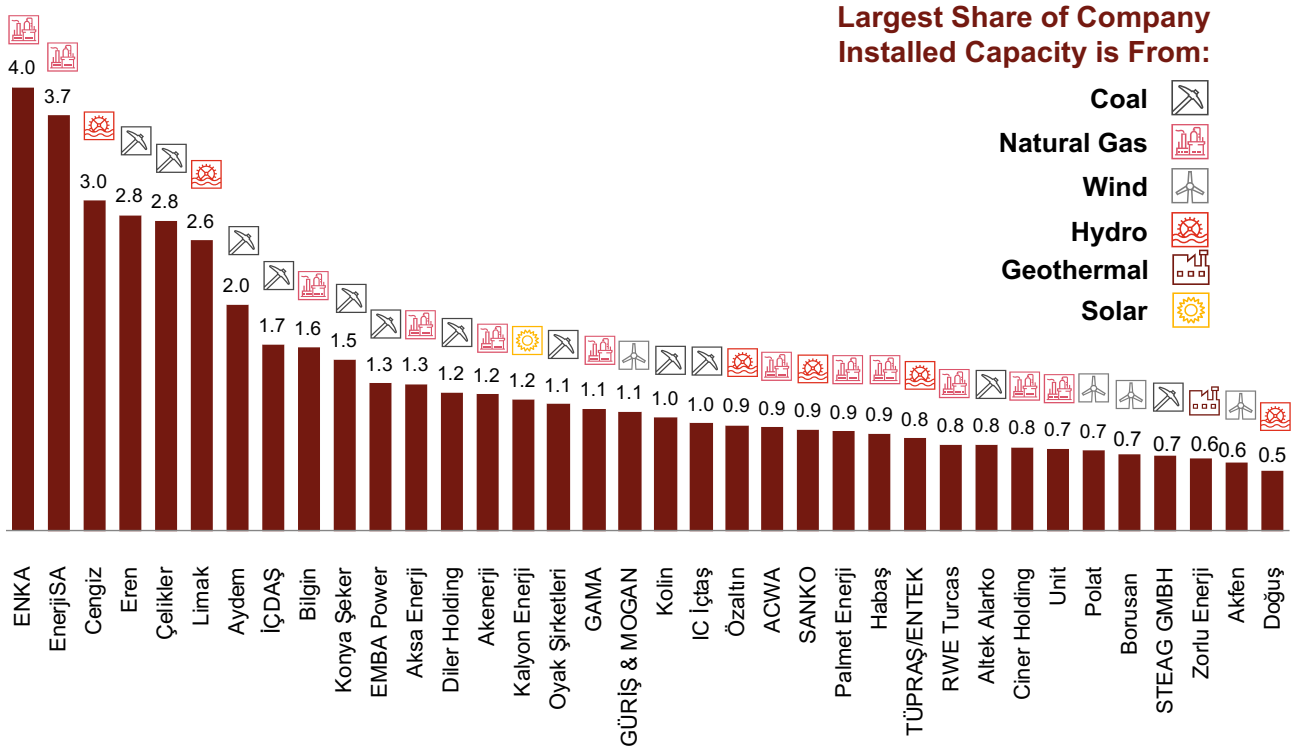
Graph 36

Installed Capacity Breakdown of Largest IPPs (2023)



Graph 37

Largest IPPs by Installed Capacity[1] (2023, GW)



[1]Installed capacities of the independent power producers have been adjusted based on the equity share of their co-owned power plants as of the date of this report. Power plants under construction were not considered as part of the total capacity. The analysis above includes ENKA and the 35 largest IPPs by installed capacity after ENKA.

Source: Publicly Available Sources (2023)

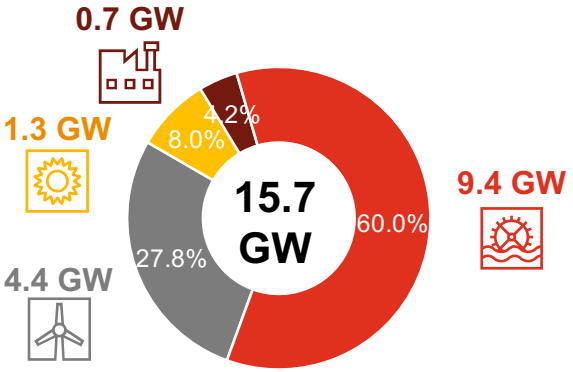
There are 20 companies in Türkiye that have more than 250 MW of capacity based on renewable sources. These companies primarily operate HPPs, with fewer large market players investing solely in wind, solar and geothermal power plants.

The largest companies in terms of installed renewable capacity primarily operate HPPs. For the companies listed below, the share of renewable assets within their total portfolios accounted for **61.1%** of total installed capacity in **2023**. Only a small portion of these companies utilize solar power plants, while several have expanded solely through Hydro and wind power plants.

All of the listed renewable investors below are publicly known to have plans to extend their renewable portfolio with new projects domestically and abroad.

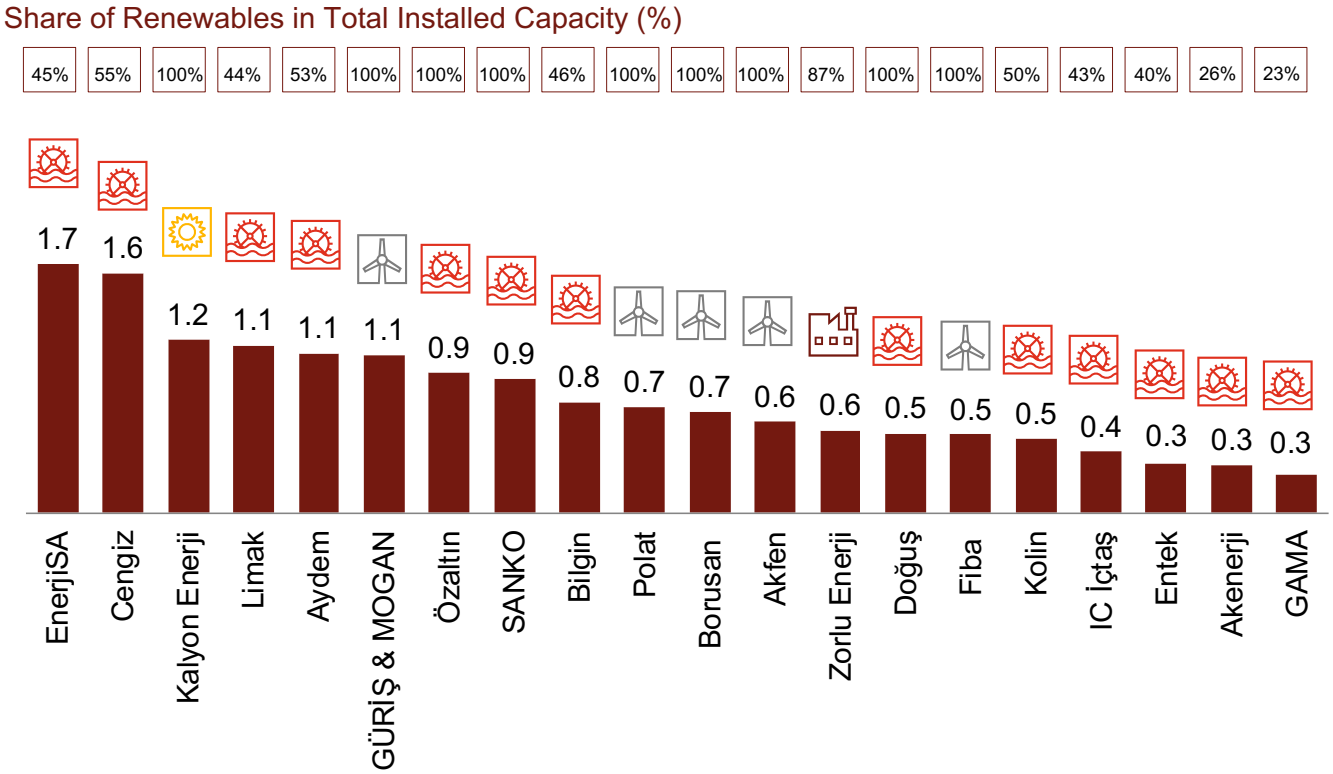
Graph 38

Renewable Capacity Breakdown of 20 Major Renewable IPPs (2023)



Graph 39

Major IPPs by Installed Capacity in Renewables (2023, GW)



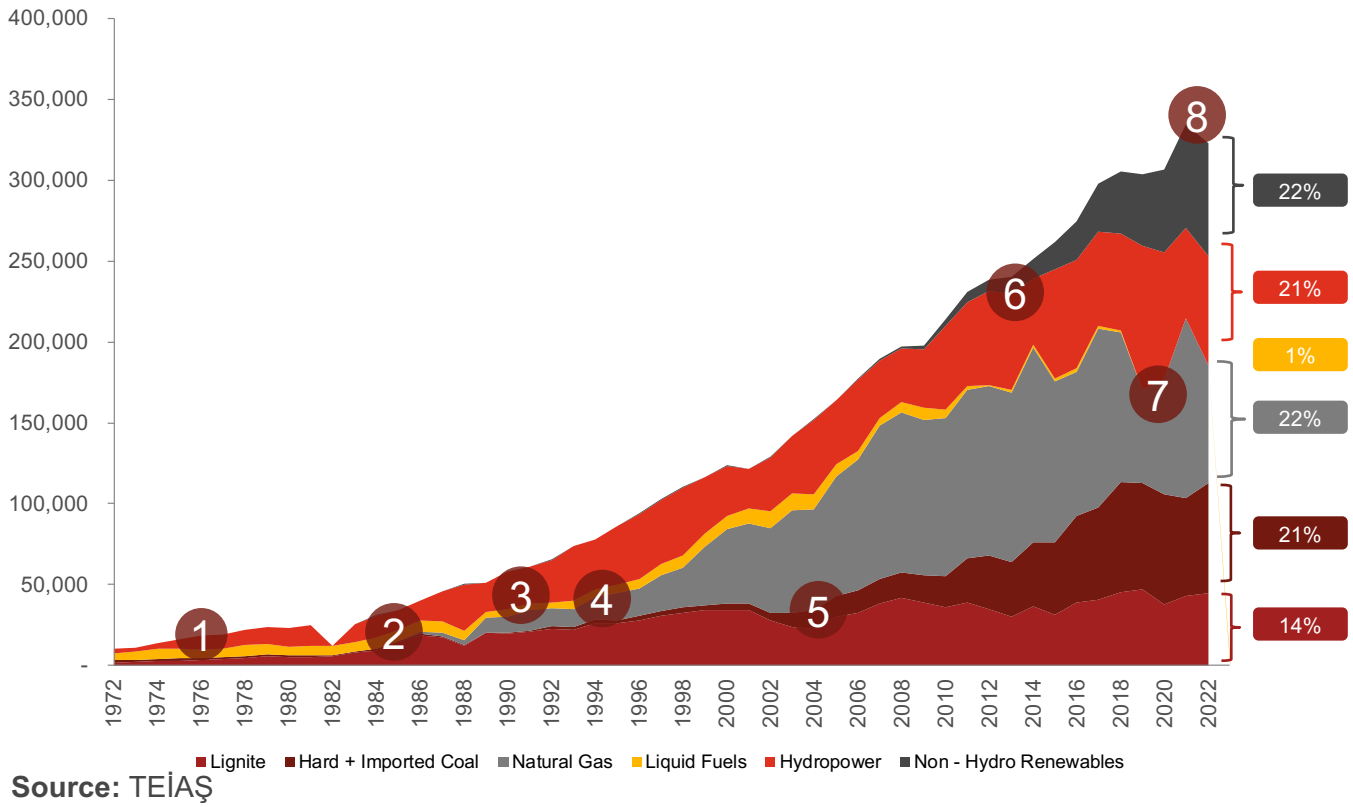
Source: Publicly Available Sources (2023)

The electricity generation mix in Türkiye has greatly diversified over the last 50 years.

1. In the 70s and early 80s, the electricity supply was made up of a mixture of hydropower, domestic coal and liquid fuels.
2. The share of liquid fuels decreased over the years as the share of coal and hydropower increased and natural gas was introduced to the generation mix.
3. Despite the increasing capacity, hydropower generation has fluctuated depending on annual climatic conditions.
4. Generation from natural gas facilities started in 1985 and picked up pace following by the first ever importing of natural gas in 1987. In the 90s, there has been a strong influx of natural gas BOT facilities.
5. The imports of hard coal began to increase following the increase of hard coal power plant investments. This increase was attributable to the lower marginal cost of generation of imported coal compared to local coal sources.
6. Share of generation from non-hydro renewables started to increase significantly post-2014 due to two main reasons:
   i) Türkiye's FIT scheme under YEKDEM started to provide more favorable price levels compared to DAMP
   ii) Investment costs for renewable technologies started to decrease
7. The decrease in total electricity demand in 2020 caused by the Covid-19 epidemic trigged lower electricity prices, which led to decreases in the production of thermal power plants with high marginal costs.
8. High natural gas costs and the cutback on gas supplied from Iran led to a decrease in the performance of natural gas power plants which was compensated with additional production from hydro dams. Generation from renewable sources reached an all-time high 43% in 2022.

Graph 40

Electricity Generation by Source (1970-2022, GWh)

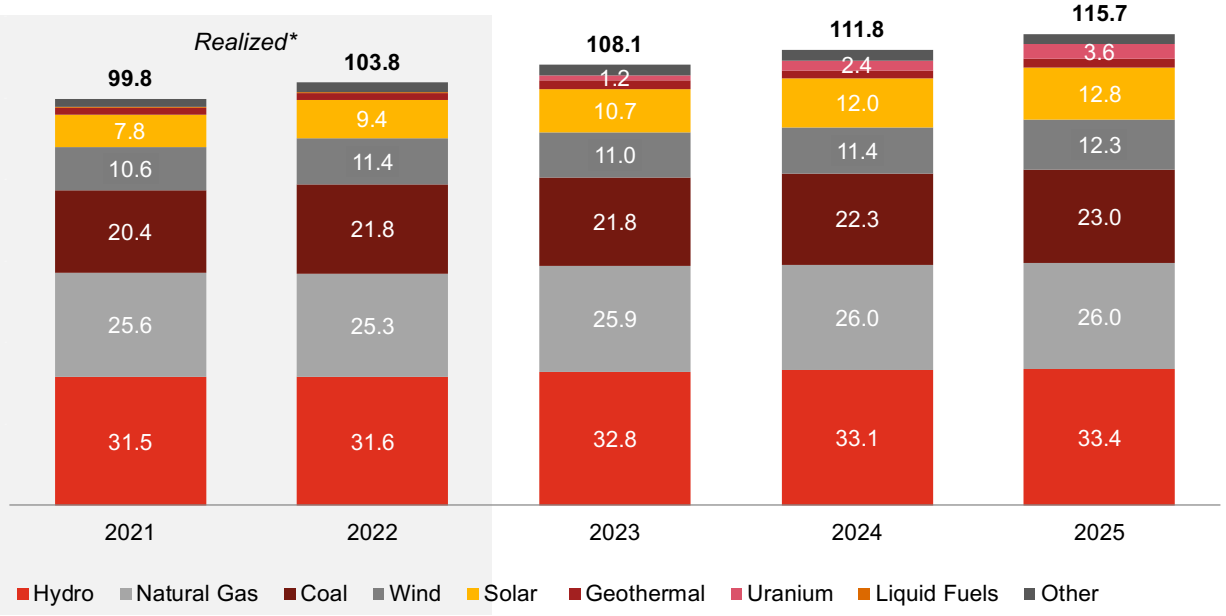


Source: TEİAŞ

TEİAŞ' 2022 expectations for the total installed capacity was to reach 104.7 GW in 2022 around 1.0 GW more than the realized installed capacity in 2022.

Graph 41

TEİAŞ Installed Capacity Forecasts (2021-2025, GW, Scenario 1)



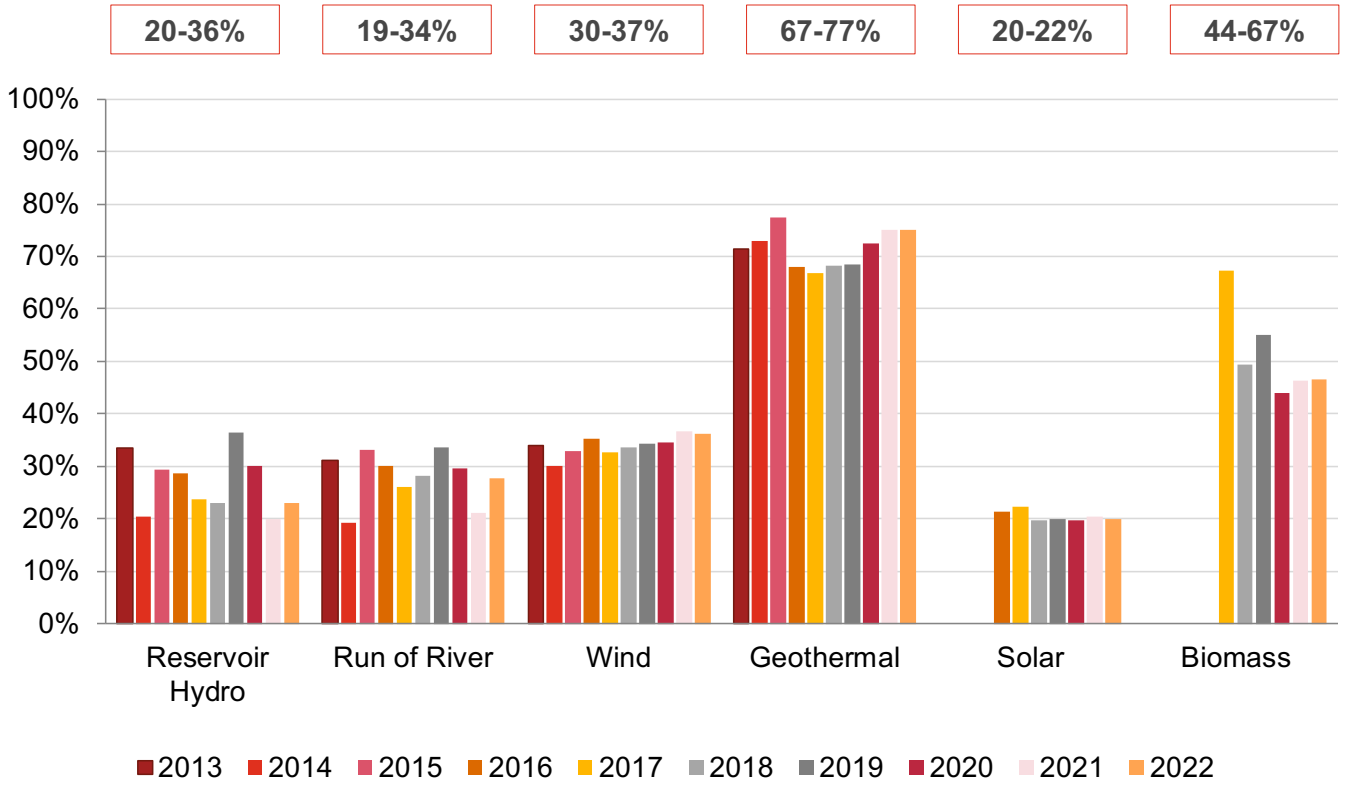
	Coal	Natural Gas	Liquid Fuels	Hydro	Geothermal	Wind	Other	Solar	Uranium	**Total**
2021	20.4	0.3	25.6	31.5	1.7	10.6	2.0	7.8	0.0	99.8
2022	21.8	0.3	25.3	31.6	1.7	11.4	2.3	9.4	0.0	103.8
2023	21.8	0.0	25.9	32.8	2.1	11.0	2.6	10.7	1.2	108.1
2024	22.3	0.0	26.0	33.1	2.1	11.4	2.6	12.0	2.4	111.8
2025	23.0	0.0	26.0	33.4	2.1	12.3	2.6	12.8	3.6	115.7

Source: TEİAŞ

Türkiye's renewable energy sources exhibit varying capacity factors, hydro sources tend to have the most fluctuating capacity factor.

Graph 42

Capacity Factors (2013-2022)



Capacity factor refers to how much electricity a plant generates compared to its theoretical maximum generation capacity.

Source: TEİAŞ

The energy mixes of most countries around the world are dominated by fossil fuels.

Table 10

Generation Mix by Country (2021)

	Natural Gas	Coal	Nuclear	Hydro	Non-Hydro Renewables	Total Renewables
	33%	**31%**	**0%**	**17%**	**17%**	**33%**
	6%	1%	65%	11%	16%	26%
	40%	2%	15%	2%	38%	39%
	51%	5%	0%	15%	25%	40%
	15%	28%	12%	3%	37%	41%
	9%	73%	0%	1%	16%	17%
	25%	2%	21%	11%	35%	46%
	13%	4%	2%	56%	22%	78%
	28%	8%	44%	0%	19%	19%
	16%	16%	20%	29%	16%	45%
	61%	2%	7%	13%	11%	24%
	60%	4%	4%	10%	12%	22%
	0%	86%	4%	0%	7%	7%
	46%	15%	3%	0%	33%	33%

Source: TEİAŞ, IEA

Hybrid generation plants are created by combining electricity generation plants that use different technologies. The main purpose of these plants is to generate electricity with maximum efficiency.

On 5 November 2022, the Turkish Energy Market Regulatory Board's (the Board) decision amending the Principles and Procedures on the Determination of Power Plant Fields of Generation Facilities Subject to Pre-license or License in Electricity Market (the Principles and Procedures) has been published in the Official Gazette of Türkiye.

The amendment **removed** the **limits** regarding the total **installed capacity** of the units based on supplementary sources for **hybrid** power plants using **wind power** as the main resource. Hybrid power plants using wind as the main source will not be subject to the below limits set forth by article 24(1) of the Principles and Procedures with regards to their units generating electricity from supplementary sources:

Total Capacity ≤ 50 → The total capacity using supplementary sources cannot exceed the total installed capacity of the units using the main source

Total Capacity > 50 → The total capacity using supplementary sources cannot exceed the sum of 50MW and the half of the amount of total capacity using the main sources exceeding the 50MW

- The total capacity generating electricity from supplementary sources cannot exceed 100 MW.
- In any case, the total installed capacity for the supplementary source cannot exceed the stated MW in the license acquired from TEİAŞ.

With the new regulation change, made by the Ministry of Agriculture and Forestry, licenses for solar power plant installations were allowed in forest areas that have lost their productivity. This change in the regulatory framework aims to facilitate and incentivize the construction and implementation of hybrid solar power plant installations. After the announcement of this regulation change, 3 coal-based thermal power plants applied to EMRA to expand the installed capacity of their power plants with hybrid solar power plant investments.

Source: Official Gazette, Publicly available sources

On the slowdown of large-scale investments and changes in new regulations, a large number of renewable energy companies have announced their plans to install additional capacities and convert their single source power plants to hybrids.

Completed Hybrid Power Plants in Türkiye[1]

Alaşehir GPP (Manisa) — ZORLU ENERJİ

Main Source	Secondary Source
Geothermal	Solar
45 MW Capacity	3.75 MW Capacity

Erciyes RES (Kayseri) — ENERJİSA Türkiye'nin Enerjisi

Main Source	Secondary Source
Wind	Solar
65 MW Capacity	16 MW Capacity

Aşağı Kaleköy HPP (Bingöl) — KALEHAN GENÇ ENERJİ

Main Source	Secondary Source
Hydroelectric	Solar
500 MW Capacity	80 MW Capacity

Uşak RES (Kayseri) — Aydem enerji

Main Source	Secondary Source
Wind	Solar
62 MW Capacity	82 MW Capacity

Table 11

Announced Hybrid Power Plants[1]

Company	Power Plant	Primary Source	Primary Installed C. (MW)	Secondary Source	Secondary Installed C. (MW)
MOGAN ENERJİ YATIRIM HOLDİNG A.Ş.	Kocatepe WPP	Wind	100	Solar	33
ZORLU ENERJİ	Kızıldere III GPP	Geothermal	165	Solar	21
	Kızıldere II GPP	Geothermal	80	Solar	10
ÇELİKLER HOLDİNG	Seyitömer TPP	Thermal	600	Solar	42
	O. Tunçbilek TPP	Thermal	210	Solar	25
ENERJİSA Türkiye'nin Enerjisi	Bandırma I CCGT	Thermal	936	Solar	20
YATAĞAN TERMİK ENERJİ	Yatağan TPP	Thermal	630	Solar	85
Alto HOLDİNG A.Ş.	Karaburun WPP	Wind	223	Solar	100
Ağaoğlu	Tatlıpınar WPP	Wind	108	Solar, Wind	112
Limak Enerji Sizin Enerjiniz	Gürsöğüt HPP	Hydroelectric	56	Solar	52
Aydem enerji	Includes floating SPP, canal SPP, and field SPP projects in Aydın, Yalova, Muğla, Denizli, Adana, Tokat, and Sivas.				137
Umut İnşaat	Karaman WPP	Wind	66	Solar	45
KANGAL TERMİK SANTRAL	Kangal WPP	Wind	128	Solar	50
GLOBAL YATIRIM HOLDİNG	Aydın BPP	Biomass	12	Solar	4
GALATAWIND	Taşpınar WPP	Wind	67	Solar	43
	Üçpınar WPP	Wind	99	Solar	40
	Hasanoba WPP	Wind	51	Solar	13
	Denizli WPP	Wind	66	Solar	6
akfen YENİLENEBİLİR ENERJİ	Kocalar WPP	Wind	26	Solar	5
	Sarıtepe WPP	Wind	50	Solar	13
	Demirciler WPP	Wind	23	Solar	13
	Doğançay HPP	Hydroelectric	30	Solar	5
SELENKA ENERJİ	Bafa WPP	Wind	35	Solar	35
	Cerit WPP	Wind	92	Solar	70
emba	Hunutlu TPP	Thermal	1.320	Solar, Wind	81
AYEN ENERJİ A.Ş.	Çaypınar WPP	Wind	25	Solar	6

[1]Information based on PwC research through publicly available information.

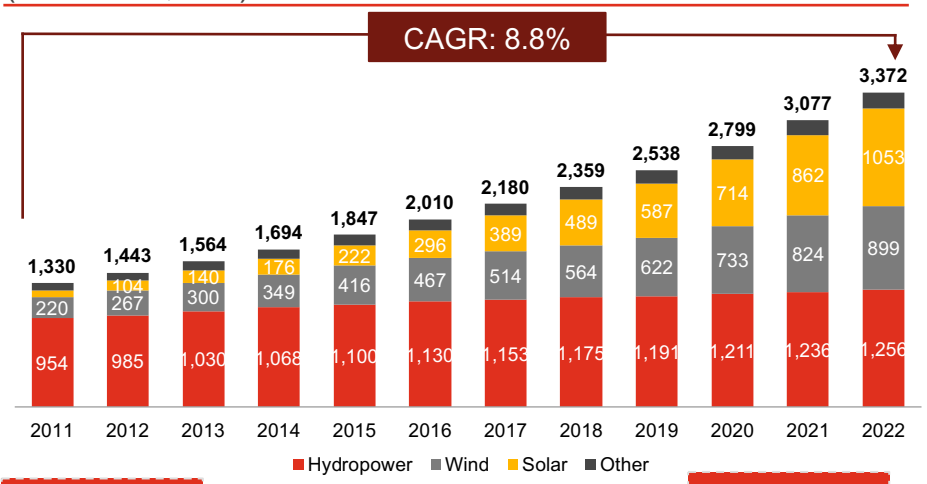
4

Development of Renewable Energy in Türkiye

The global total of renewable energy installed capacity has increased by 8.8% since 2011 and reached 3,372 GW in 2022. In the same period, renewable energy installed capacity in Türkiye had a CAGR of 10.3% and reached 56.4 GW.

Graph 43

Installed Capacity of Global Renewable Energy (2011-2022, GW)

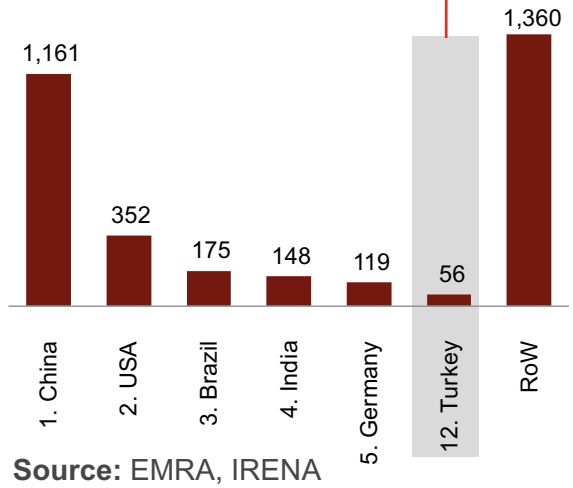


CAGR 11-22	World	Türkiye
	3%	6%
	27%	22%[1]
	14%	19%

Table 12

Global Installed Capacity Rankings for Türkiye (2010-2022)

	2010	2022
Hydropower	13th	8th
Wind	17th	12th
Solar	51th	16th
Bioenergy	47th	15th
Geothermal	12th	4th
Total	**14th**	**12th**

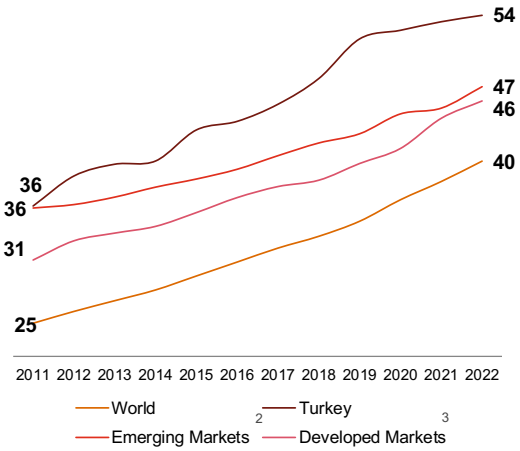


Source: EMRA, IRENA

Graph 44

Renewable energy share of electricity capacity (%)

Türkiye's focus on renewable energy over the last 10 years distinguished it from other countries. Türkiye has the 12th largest renewable energy capacity in the world.



2022

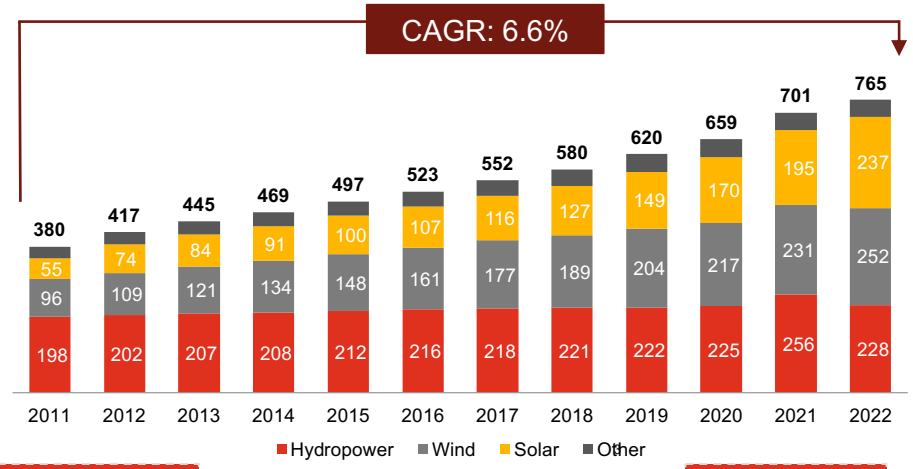
64% Amount of electricity generated from domestic resources in Türkiye

[1]The solar energy CAGR is calculated for the period between 2017 and 2022, considering realization of negligible electricity capacity from solar energy in 2016 and earlier periods.
[2]Argentina, Brazil, China, India, Indonesia, Mexico, Poland, South Africa, South Korea and Türkiye
[3]United States, Japan, United Kingdom, Canada, Germany, France, Netherlands, Italy, Spain, Australia

Installed renewable energy capacity in Europe has increased by 6.6% since 2011, reaching 765 GW in 2022. Türkiye commands the 5th largest installed renewable energy capacity in Europe, and is second only to Norway in terms of hydropower capacity.

Graph 45

Installed Capacity of Renewable Energy in Europe (2011-2022, GW)

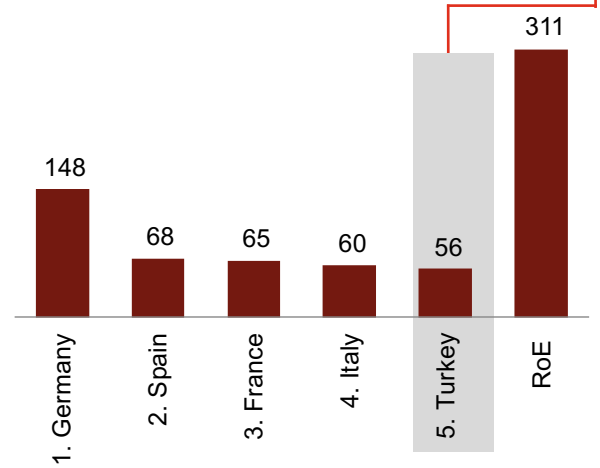


CAGR 11-22	Europe	Türkiye
	1%	6%
	14%	22%[1]
	9%	19%

Table 13

Renewable Electricity Installed Capacity Country Rankings (2022)

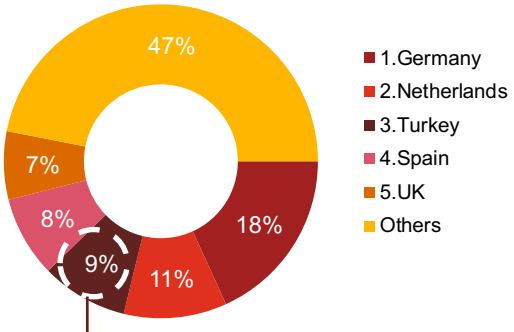
	1 st Place	2nd Place	3rd Place	Turkey's Ranking
Hydropower	Norway	Turkey	France	2nd
Wind	Germany	Spain	UK	7th
Solar	Germany	Italy	Netherlands	8th
Other	Germany	UK	Sweden	8th
Total	**Germany**	**Spain**	**France**	**5th**



Graph 46

Share of total renewable energy installed capacity addition in Europe (2016-2022)

Türkiye ranked third in Europe renewable energy installed capacity additions in the last six years.



Share	40%	4%	6%	14%
Ranking	1st	7th	6th	4nd

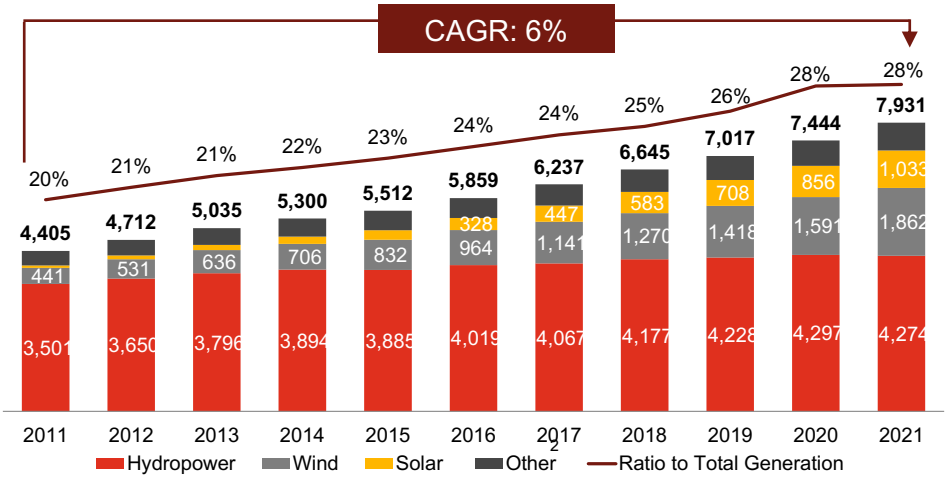
Source: IRENA, Fitch, EMRA

[1] The solar energy CAGR is calculated for the period between 2017 and 2022 considering realization of negligible electricity capacity from solar energy in 2015 and earlier periods.
[2] Includes electricity installed capacity from geothermal, biomass and other

The total global electricity generation of renewable energy increased by 6% each year since 2011 and reached 7,931 TWh in 2021. Total electricity generation in Türkiye reached a record high of 334.7 TWh in 2021, more than double the level in 2000 while considerable contribution came from renewable sources with a CAGR of 7% between the period of 2011 and 2021.

Graph 47

Development of Global Renewable Electricity Generation (2011-2021, TWh)

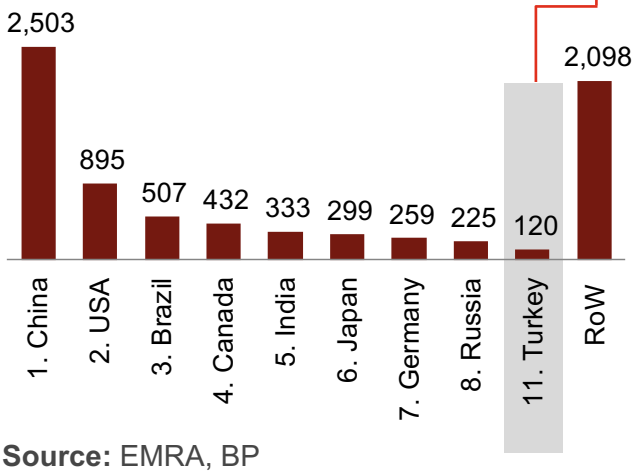


CAGR 11-21	World	Türkiye
	2%	1%
	32%	68% [1]
	16%	21%

Table 14

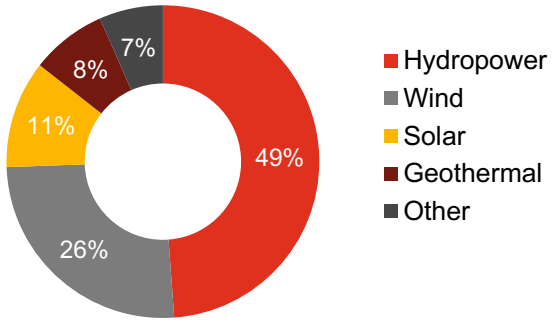
Renewable Electricity Generation Country Rankings (2021, TWh)

	1st Place	2nd Place	3rd Place	Turkey's Ranking
Hydropower	China	Canada	Brazil	9th
Wind	China	USA	Germany	9th
Solar	China	USA	Japan	12th
Other[2]	China	USA	Brazil	10th
Total	**China**	**USA**	**Brazil**	**11th**



Graph 48

Technology Breakdown of Renewable Electricity Generation in Türkiye (2022)



Türkiye has experienced impressive growth in renewables in the past decade driven by a favorable resource endowment, strong energy demand growth and supportive government policies. Accordingly, renewable electricity generation for Türkiye has nearly tripled in the last decade.

Source: EMRA, BP

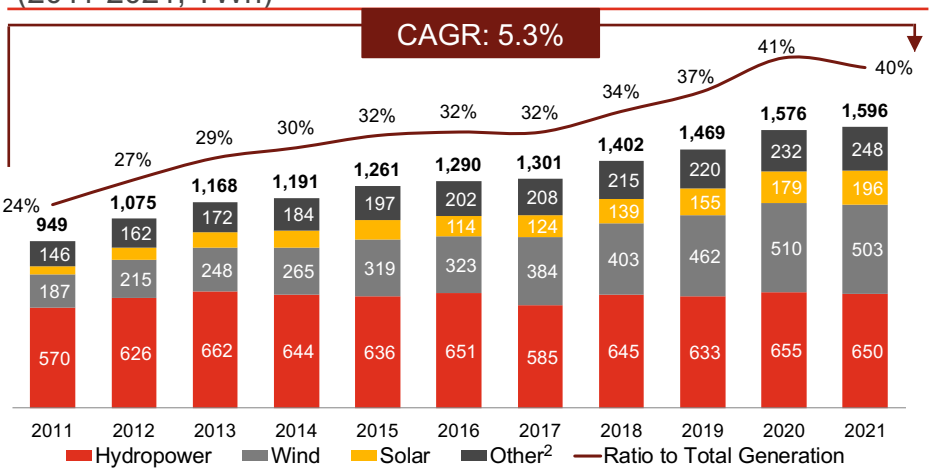
[1] The solar energy CAGR is calculated for the period between 2016-2021 considering realization of negligible electricity generation from solar energy in 2015 and earlier periods.

[2] Includes electricity generated from geothermal, biomass and other.

From a generation point of view, Türkiye is fifth in Europe in terms of utilisation of renewable sources.

Graph 49

Development of Renewable Electricity Generation in Europe (2011-2021, TWh)

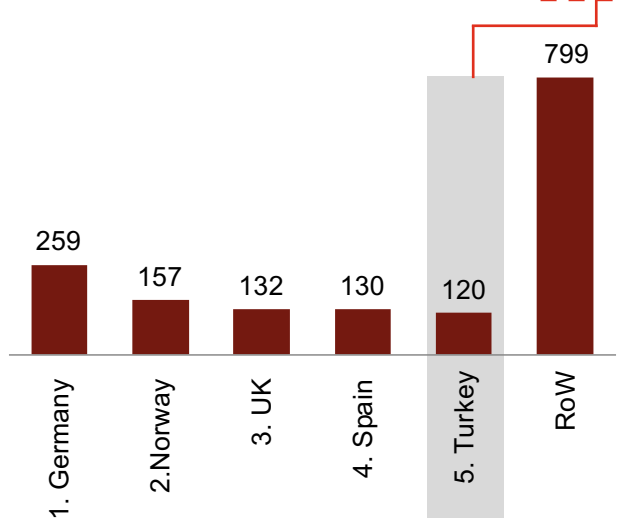


CAGR 11-21	Europe	Türkiye
	1%	1%
	11%	68% [1]
	10%	21%

Table 15

Renewable Electricity Generation Country Rankings (2021, TWh)

	1st Place	2nd Place	3rd Place	Turkey's Ranking
Hydropower	Norway	Sweden	Turkey	3th
Wind	Germany	UK	Spain	5th
Solar	Germany	Spain	Italy	5th
Other[2]	Germany	UK	Italy	4th
Total	**Germany**	**Norway**	**UK**	**5th**

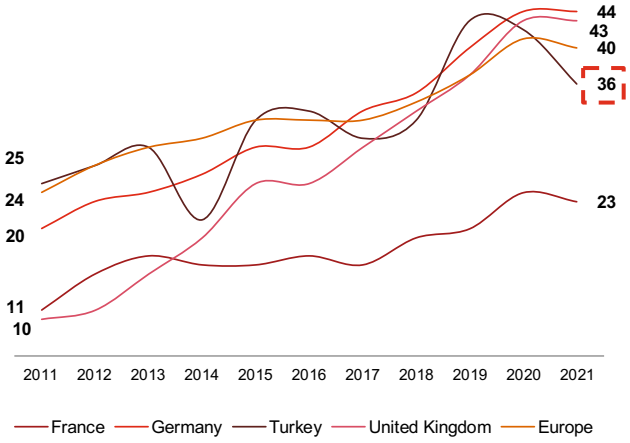


Source: BP, EMRA

Graph 50

Renewable energy share of total electricity generation (%)

Share of renewables in electricity generation was realized at 36% for Türkiye in 2021 due to a periodical setback in hydro generation. Türkiye's current potential and installed capacity enables it to source **40-45%** of electricity from renewable sources.



[1] The solar energy CAGR is calculated for the period between 2016 and 2021 considering realization of negligible electricity generation from solar energy in 2015 and earlier periods.

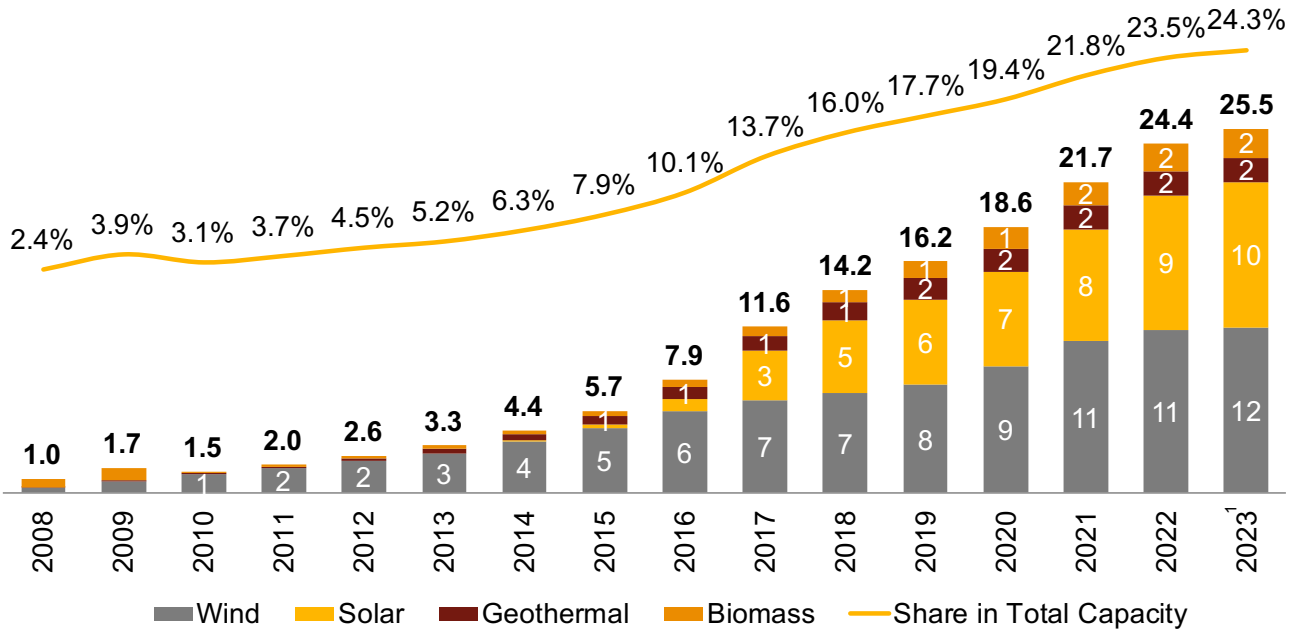
[2] Includes electricity generated from geothermal, biomass and other.

Non-hydro renewable installed capacity in Türkiye grew substantially in the last decade due to continuous government support, particularly through YEKDEM.

Development of Non-Hydro Renewables	December 2008	June 2023	% of Total Capacity as of June 2023
Wind Large amount of investments due to attractive FiT Schemes under YEKDEM	364 MW	11,566 MW	11.0%
Solar Strong growth in the past few years, mainly attributable to unlicensed generation	0 MW	10,192 MW	9.7%
Geothermal High number of geothermal sources in Türkiye which can be utilized for generation	30 MW	1,691 MW	1.6%
Biomass Less interest due to high CAPEX and dependency on external source factors (waste collection).	597 MW	2,031 MW	1.9%

Graph 51

Installed Capacity of Non-Hydro Renewables (2007-2023, GW)

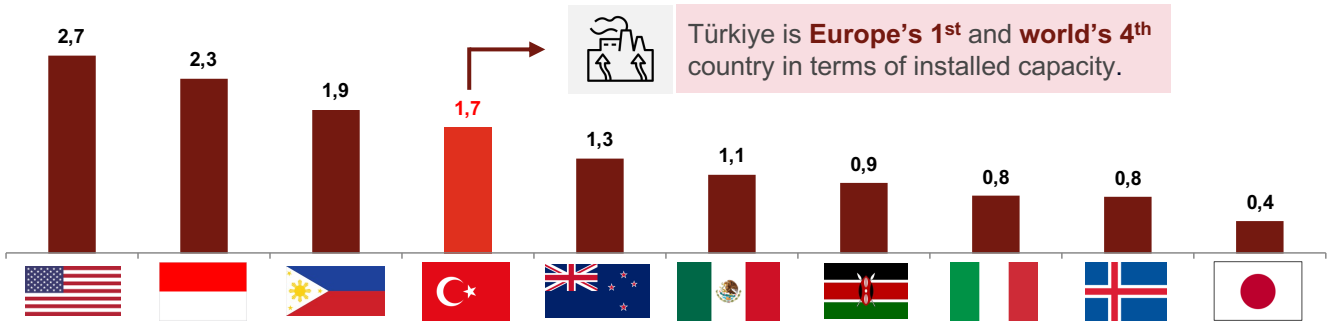


[1]Data as of June 2023
Source: TEİAŞ

Türkiye's active tectonic zone geological location makes the country rich in terms of it geothermal energy resources. Türkiye has more than 1,000 geothermal springs with different temperatures.

Graph 52

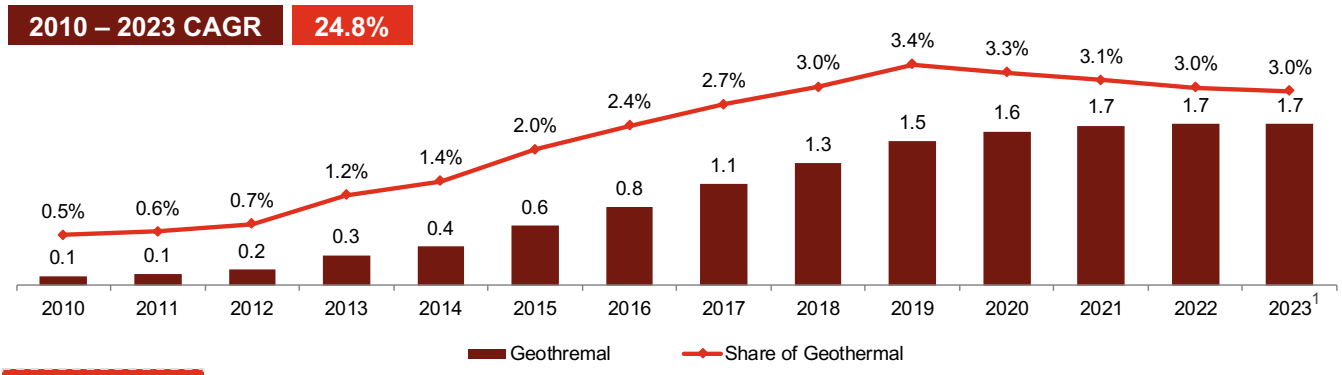
Top 10 Countries with the highest Geothermal Energy Installed (GW)[1]



Türkiye is **Europe's 1st** and **world's 4th** country in terms of installed capacity.

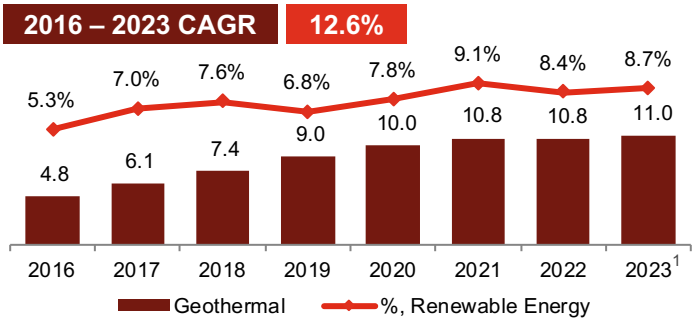
Graph 53

Türkiye's Geothermal Installed Capacity (GW) and Share in Renewable Capacity (%)



Graph 54

Electricity Generation by Geothermal Energy and Share in Renewables (TWh)[1]



According to the National Energy Plan, the **capacity** of **geothermal** and **biomass** power plants is projected to be **5,1 GW** in **2035** (**3,7 GW** currently).

78% of the active **geothermal power plants** are located in **Western Anatolia** (Aydın, Manisa and Denizli). **9%** in **Central Anatolia**, **7%** in the **Marmara**, **5%** in **Eastern Anatolia** and **1%** in **other regions**.

[1]LTM As of June 2023

Source: Türkiye's National Energy Plan, MENR, IRENA Renewable Capacity Statistics 2023

The biggest Geothermal energy portfolio is owned by Zorlu Enerji (305 MW), MOGAN (260 MW), Kipaş Holding (230 MW), and Çelikler Holding (215 MW), respectively. MOGAN's portfolio stands out as it comprises the largest combined capacity organized in a single location (Aydın) and generates the highest amount of electricity compared to other GPP portfolios.

ZORLU

Installed Capacity → **305 MW**

Share in Total Capacity **%18.2**

MW	305
Kızıldere 3	165
Kızıldere 2	80
Alaşehir 1	45
Kızıldere 1	15

MOGAN ENERJİ YATIRIM HOLDİNG A.Ş.

Installed Capacity → **260 MW**

Share in Total Capacity **%15.4**

MW	260
Galiphoca	47
Efe1	47
Efe2	23
Efe3	23
Efe4	22
Efe6	23
Efe7	25
Efe8	50

KİPAŞ

Installed Capacity → **230 MW**

Share in Total Capacity **%16.6**

MW	260
Maren	44
Melih	33
Ken3	25
Mehmethan	25
Deniz	24
Ken	24
Kerem	24
Nezihe	20
Kiper1	10

ÇELİKLER HOLDİNG

Installed Capacity → **215 MW**

Share in Total Capacity **%12.8**

MW	215
Pamukören1	68
Pamukören4	32
Pamukören5	32
Pamukören2	22
Pamukören3	22
Sultanhisar2	23
Sultanhisar1	14

Source: Publicly Available Sources

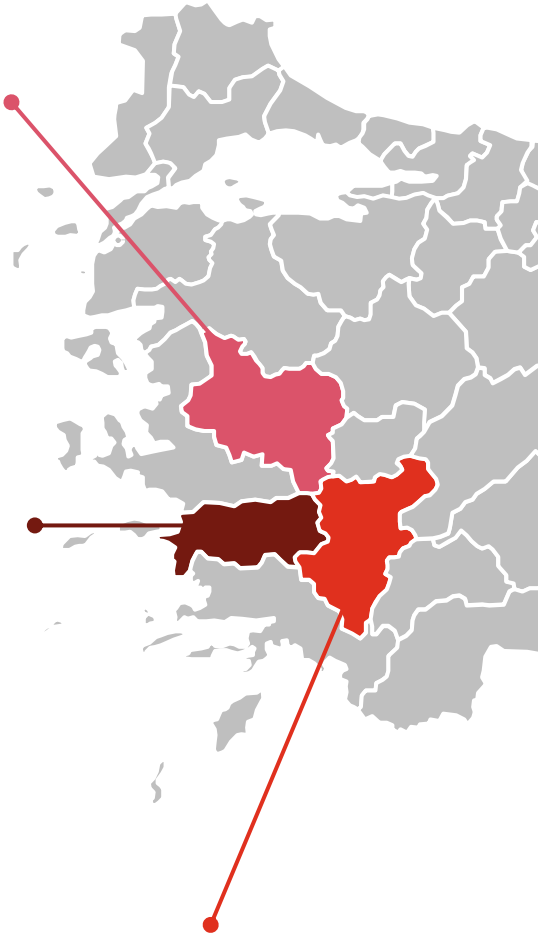
The 3 biggest Geothermal Power Plants (in terms of its installed capacity), is owned by Zorlu Enerji (Kızıldere 3 & 2) and MOGAN (Galip Hoca JES - Efeler JES – Efe 6 – Efe 7 – Efe 8).

Top 10 Biggest Geothermal Power Plants

Manisa		
7	Zorlu Enerji – Alaşehir GPP	45 MW
9	MB Holding – Dora 3	34 MW
Total Installed Capacity		349 MW

Aydın		
2	MOGAN – Efeler GPP	115 MW
4	Çelikler Enerji - Pamukören	68 MW
5	MOGAN – Efe 8	50 MW
6	MOGAN – Galip Hoca	47 MW
8	Kipaş Holding – Maren JES	44 MW
10	Kipaş Holding – Melih GPP	33 MW
Total Installed Capacity		8.401 MW

Denizli		
1	Zorlu Enerji – Kızıldere 3	165 MW
3	Zorlu Enerji – Kızıldere 2	80 MW
Total Installed Capacity		375 MW



Source: Publicly Available Sources, EMRA

The introduction of YEKDEM to the Turkish electricity market increased investments in renewable energy power plants, as it provided the required framework and incentives for market players looking to engage in renewable investments.

The initial YEKDEM FiT provided renewable generators with the option to sell their output at fixed prices for ten years. **Renewable energy power plants commissioned up to 30 June 2021 were covered by the initial FiT of the YEKDEM scheme**.

Table 16

Initial YEKDEM Feed-in Tariff

Renewable Energy Source	Feed-in Tariff (USD/MWh)	Local Component Incentive (USD/MWh)
Hydroelectric	73	10 – 23
Wind	73	6 – 37
Geothermal	105	7 – 27
Solar	133	4 – 56
Biomass	133	5 – 67

The first version of the support mechanism offered USD denominated purchase guarantees for the power plants enlisted in the scheme. In addition to 10-year FiT enlisting plants were granted USD denominated local component incentives, if the criterias were met. As the frequency of the large-scale currency depreciations increased, the MENR has decided to introduce a new support mechanism encompassing new conditions for the power plants to be commissioned after June 30, 2021.

First implemented in May 2005, initial YEKDEM played a substantial role in kickstarting the development of non-hydro renewable installed capacity. Especially in the period between 2016 and 2019, unlicensed solar power installed capacity experienced a significant boom thanks to lucrative FiT provided by initial YEKDEM. In 2019, with the legislation change regarding the unlicensed plants, only licensed plants became eligible for YEKDEM FiT. After switching to the TL denominated FiT in 2021, YEKDEM lost further popularity among renewable energy generators. Therefore, latest YEKDEM list mostly includes plants which are still eligible to benefit from the initial YEKDEM.

Installed Capacity of Renewables in Final YEK List (2023,GW)

Hydroelectric
# of plants **310**
Installed capacity
7.6 GW

Wind Power
# of plants **196**
Installed capacity
8.0 GW

Biomass
# of plants **285**
Installed capacity
2.2 GW

Geothermal
# of plants **55**
Installed capacity
1.6 GW

Solar Power
# of plants **36**
Installed capacity
0.5 GW

Compared to June 2023 non-hydro renewables capacity, Final YEK List does not include: 1) older WPPs due to 10 year limit on FiT, 2) unlicensed SPPs eligible for YEKDEM since these plants benefit from FiT through distribution companies, 3) Karapınar YEKA-1 SPP due to having its own tender bid price.

Source: EMRA

First introduced in 2005, YEKDEM Feed-in Tariff attracted the attention of investors after 2015 due to the sharp drop observed in DAMP. YEKDEM FiT scheme has been updated in 2021 and 2023.

As the frequency of the large-scale currency depreciations increased, USD denominated YEKDEM FiT started to cause fiscal pressure on the Treasury. As a result, MENR introduced a new TL denominated support mechanism encompassing new conditions for the power plants to be commissioned after June 30, 2021. The power plants commissioned between July 1, 2021 and December 31, 2025 will be eligible to benefit from the new TL denominated 10-year FiT. The new schedule includes a domestic component incentive for 5 years if it is approved that 51% of the components used in the power plant are domestically manufactured.

On May 1, 2023 , the new FiT mechanism was revised and extended to better reflect the expectations of the market participants and respond to the recent developments in the energy markets. Compared to second iteration of the FiT, the latest iteration included an overall hike in FiT and weights of the hard currencies used in the escalation formula have been increased.

Table 17

Latest YEKDEM Feed-in Tariff from May 2023

Renewable Energy Source		Feed-in Tariff (TL/MWh)	Feed-in Tariff Duration (Years)	Feed-in Tariff Floor (USD/MWh)	Feed-in Tariff Ceiling (USD/MWh)	Local Component Incentive (TL/MWh)	Local Component Incentive Duration (Years)
Hydroelectric	Reservoir	1,440.0	10	67.5	82.5	288.0	5
	Run of River	1,350.0	10	63.0	77.0	288.0	5
Wind	Onshore	1,060.0	10	49.5	60.5	288.0	5
	Offshore	1,440.0	10	67.5	82.5	384.5	5
Geothermal		2,020.0	15	94.5	115.5	288.0	5
Biomass	Landfill Gas	1,060.0	10	49.5	60.5	288.0	5
	Biomethanization	1,730.0	10	81.0	99.0	288.0	5
	Thermal Disposal	1,349.0	10	57.5	80.0	215.8	5
Solar		1,060.0	10	49.5	60.5	288.0	5
Solar / Wind with Storage		1,250.0	10	58.5	71.5	384.5	10
Pumped-storage Hydroelectric		2,020.0	15	94.5	115.5	384.5	10
Wave & Marine Current Power		1,350.0	10	63.0	77.0	384.5	10

Most Prominent Changes Implemented with the Latest YEKDEM

- **Inclusion of offshore wind, storage facilities, pumped-storage hydroelectric and wave & marine current power to the FiT**
- **Extension of FiT duration provided to geothermal plants to stimulate stagnant GPP installed capacity**
- **Introduction of a FiT floor in addition to ceiling to better absorb the FX rate risk faced by IPPs**
- **Application of escalation formula for the local component incentive (previously only FiT was subjected to escalation)**
- **Increased focus on changes in FX rates regarding the escalation formula (previously inflation indexes had the larger weight)**
- **Escalation frequency reduced to monthly updates (previously FiT was updated quarterly)**
- **The power plants commissioned between July 1, 2021 and December 31, 2030 will be eligible to benefit from their respective FiT displayed above (previously the eligibility interval ended on and December 31, 2025).**

Source: EMRA

Third iteration of YEKDEM Feed-in Tariff supports a more reflexive and hard-currency based scheme for the eligible renewable energy power plants.

YEKDEM Escalation Mechanism Implemented in 2021

$$YEKDEM\ FiT\ on\ Month\ M = YEKDEM_M = YEKDEM_{M-3} \times \left[\left(26\% \times \frac{PPI_{M-2}}{PPI_{M-5}}\right) + \left(26\% \times \frac{CPI_{M-2}}{CPI_{M-5}}\right) + \left(24\% \times \frac{USD_{M-2}}{USD_{M-5}}\right) + \left(24\% \times \frac{EUR_{M-2}}{EUR_{M-5}}\right)\right]$$

Weight of Inflation Indexes: **52%**

Weight of Change in FX Rates: **48%**

Update Frequency: 3 Months

YEKDEM Escalation Mechanism Updated in May 2023

$$YEKDEM\ FiT\ on\ Month\ M = YEKDEM_M = YEKDEM_{M-1} \times \left[\left(25\% \times \frac{PPI_{M-2}}{PPI_{M-3}}\right) + \left(15\% \times \frac{CPI_{M-2}}{CPI_{M-3}}\right) + \left(30\% \times \frac{USD_{M-1}}{USD_{M-2}}\right) + \left(30\% \times \frac{EUR_{M-1}}{EUR_{M-2}}\right)\right]$$

$$Local\ Component\ Incentive\ on\ Month\ M = LCI_M = LCI_{M-1} \times$$

Weight of Inflation Indexes: **40%**

Weight of Change in FX Rates: **60%**

Update Frequency: 1 Month

With the revision implemented on May 1, 2023, the escalation formula used to update the Feed-in Tariff became more reflexive due to more frequent updates. As a result of the change in weights of the escalation formula components, FiT became more responsive to the changes in USD and EUR FX rates, which have substantial impact on Turkish energy markets. Both with the introduction of USD denominated FiT floor and changes in the formula weights reduce the FX rate risk of renewable energy producers, similar to the USD denominated initial YEKDEM FiT.

Source: EMRA

Türkiye's wind and solar power capacity development has been realized in several phases. After an initial phase without auctions, wind and solar tenders were made, followed by the use of the large-scale YEKA model. Currently; YEKA model, TEİAŞ allocations and capacity allocations coupled with storage capacity are being used.

A Initial YEKDEM Phase

- Initial YEKDEM phase which received limited attention
- Feed-in-tariffs provided on a first come, first served basis
- No tender process in place.

B 2011 Wind Tenders

- Based on a contribution fee to be deducted from the YEKDEM FiT
- Contribution fee on a TL/kWh basis, to be paid 20 years after the COD
- 5,500 MW of wind power capacity allocated in 13 competition regions.

C 2015 Solar Tenders

- New auction system commenced in 2015 for solar power plants
- TL-based contribution fees per MW to be paid 3 years after COD
- 600 MW of solar power capacity allocated.

D 2017 Wind Tenders

- 3,000 MW of capacity was allocated
- No YEKDEM FiT scheme, price offers based on independent offers or discounts based on future DAMP (negative price offers)

E YEKA Tenders

- Organized for large and mid-scale projects to be awarded to single investor or multiple investors.
- Bidders offer a discount on the defined ceiling price per kWh. A PPA is signed for 15 years or a specific amount of electric to be produced.

F Current Capacity Allocation Scheme

- **Currently only YEKA SPP 5 tender (1.5 GW capacity) has been scheduled.**
- **In addition, TEİAŞ announces monthly available regional capacities for (1) installed capacity additions for operational plants, (2) unlicensed plants and (3) hybrid power plants.**
- **Third and last wind and solar capacity allocation method is through storage facility licenses. EMRA enables investors to install solar or wind capacity equal to the storage capacity declared in the license.**

Source: EMRA

YEKA tenders occurred in 2017-2019 period, had allocated larger scale of installed capacities to fewer number of investors. After 2020, the allocation strategy shifted towards smaller capacities. Thus, MENR allowed smaller scale investors to participate in YEKA tenders.

Table 18

YEKA SPP Tenders

	YEKA SPP-1	YEKA SPP-3	YEKA SPP-4		
Location	Konya - Karapınar	36 Connection Regions	Bor 3 Connection Regions	Erzin 2 Connection Regions	Viranşehir 10 Connection Regions
Date	March 20, 2017	April-May 2021	Apr-22	Jun-22	Jun-22
Capacity	1,000 MW	1,000 MW	300 MW	200 MW	500 MW
Ceiling Price	80 USD / MWh	350 TRY / MWh	950 TRY / MWh	950 TRY / MWh	
Winning Bid	69.9 USD / MWh	218 TRY / MWh	397 TRY / MWh	590 TRY / MWh	539 TRY / MWh
Sponsor Company	Kalyon	Margün, Gün Güneş, Bakırlar Tekstil, Eksim	Smart GES, Ecogreen, Kalyon	Limak, IC İçtaş Enerji	Egesa, Eksim, Kalyon, Ral Enerji, Reşitoğlu
Power Purchase Guarantee Period	15 Years	First 23 GWh/MW to be produced per Mwe	First 23 GWh/MW to be produced per Mwe		
Local Content Ratio	60% for the first 500 MW, 70% for the second 500 MW	60%	75%		

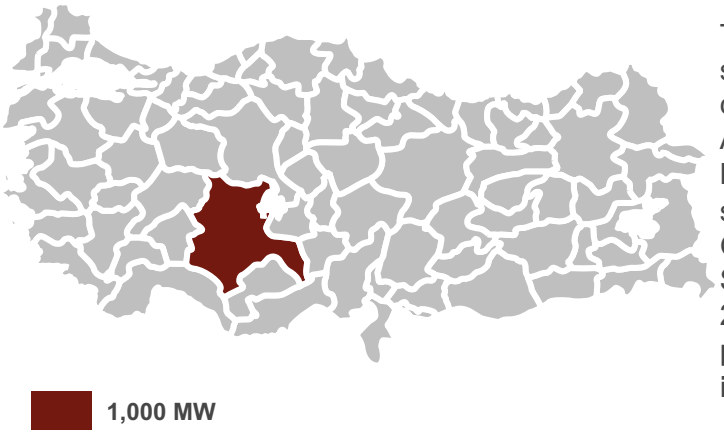
Table 19

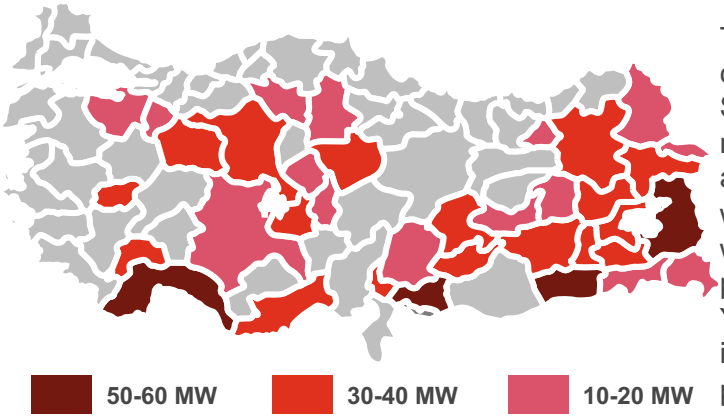
YEKA WPP Tenders

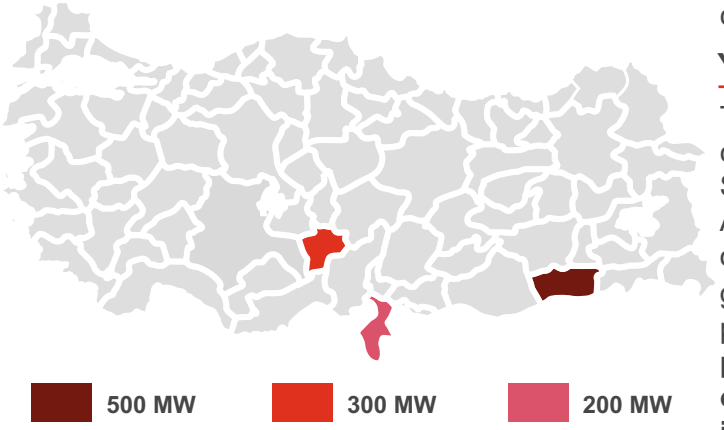
	YEKA WPP-1	YEKA WPP-2	YEKA WPP-3
Location	Edirne, Kırklareli, Sivas, Eskişehir	Aydın, Balıkesir, Çanakkale, Muğla	20 Connection Regions
Date	August 3, 2017	May 30, 2019	May-June 2022
Capacity	1,000 MW	1,000 MW (4 x 250 MW)	850 MW
Ceiling Price	80 USD / MWh	55 USD / MWh	950 TRY / MWh
Winning Bid	34.8 USD / MWh	35.3 - 45.6 USD / MWh	596.9 TRY / MWh
Sponsor Company	Kalyon, Siemens Gamesa, Türkerler	Enerjisa, Çanakkale Enercon	Eksim ve Rönensas Holding, Kalyon Enerji, RHG Enertürk
Power Purchase Guarantee Period	15 years	15 years	First 35 GWh/MW to be produced per Mwe
Local Content Ratio	60%	55%	55%

Source: MENR

Compared to YEKA SPP-1, where the power purchase guarantee was given by a specific time period, SPP-3 and SPP-4's power purchase guarantee shifted towards a specific limit to electricity generation.







Source: MENR

YEKA SPP-1

The prerequisite for SPP-1 tender was to build a solar panel and cell factory in Ankara which was completed on February 2023 (1,262 MWm). In August 2020, Kalyon Group commissioned the Kalyon Solar Technologies to build the first section of the plant. With a total capacity of 1 GW, Kalyon owns the Türkiye's highest capacity SPP in Türkiye, located in Konya Karapınar. In 2022, **Kalyon Group sold 50% stake in the power plant to Abu Dhabi's IHC for USD 490m in 2022.**

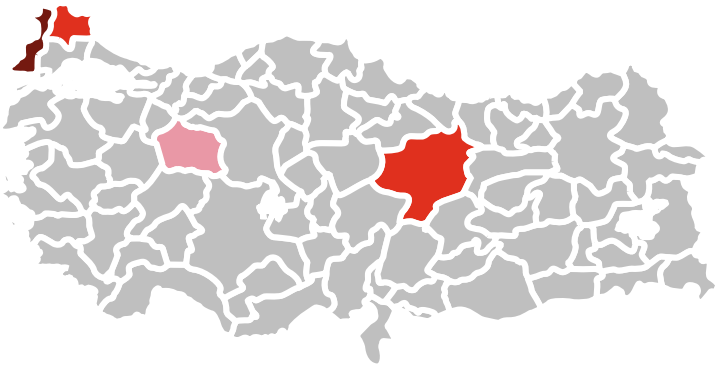
YEKA SPP-3

The Mini YEKA SPP-3 tender for 74 SPPs in 36 cities with a total capacity of 1,000 MW covers SPPs with a capacity of 10, 15 and 20 MW. As a result of the price bids received through open auction, tenders with a 15-year purchase guarantee were given. It was stated that the purchase price would not exceed USD 53/MWh during the purchase guarantee period. Compared to previous YEKAs', this tender allocated smaller capacities into more cities which allowed small investors to participate. In YEKA SPP-3, the prices were TL denominated though supported with an escalation mechanism, to incorporate the inflation index and FX currency risks.

YEKA SPP-4

The Mini YEKA SPP-4 tender for 15 SPPs in 3 cities with a total capacity of 1,000 MW covers SPPs with a capacity of 200, 300 and 500 MW. As a result of the price bids received through open auction, purchase price guarantees were given to the winners for the first 23 GWh to be produced per Mwe in each plant. **Compared to previous YEKA SPP tenders, MENR gave the option to sell the electricity to the spot market instead of the agreed-upon tender price after the pre-license signature date in the case the facility is erected earlier than otherwise suggested by the licence requirements, and the right to install a storage capacity.**

Compared to YEKA WPP Tenders before 2020 period, the allocated capacities to the regions are divided into much smaller fractions in YEKA WPP-3.



200-300 MW 100-200 MW 50-60 MW

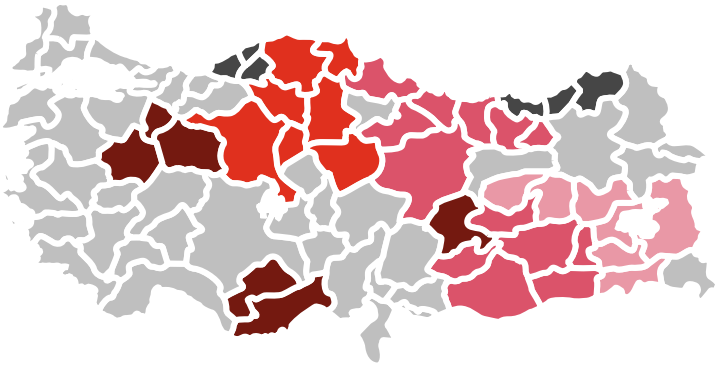
YEKA WPP-1

The YEKA WPP-1 tender for 6 WPPs in 4 cities with a total capacity of 1,000 MW, was given to Kalyon-Türkerler and Siemens Gamesa consortium. As a result of the price bids received through open auction, winning consortium was awarded a 15-year purchase guarantee for 3.48 USD/kWh.

250 MW

YEKA WPP-2

The YEKA WPP-2 tender for 4 WPPs in 4 cities with a total capacity of 1,000 MW was awarded to Enerjisa Üretim-Enercon consortium. Enerjisa Üretim signed a turbine purchase agreement with Enercon in 2022 and all plants are expected to commence operations in 2024.



70-80 MW 40-50 MW 20-30 MW

YEKA WPP-3

The YEKA WPP-3 tender was for several SPPs in 20 cities with a total capacity of 850 MW. As a result of the price bids received through open auction, winners were awarded purchase guarantee for the first 35 GWh to be produced per MW. The lowest bid was realized at 40.8 TL/kWh by Eksim Holding. Eksim Holding and Kalyon Enerji were the biggest tender winners with a capacity of 260 MW for each investor. **Compared to previous YEKA WPP tenders, MENR gave the option to sell the electricity to the spot market instead of the agreed-upon tender price after the pre-license signature date in the case the facility is erected earlier than otherwise suggested by the license requirements, and the right to install a storage capacity.**

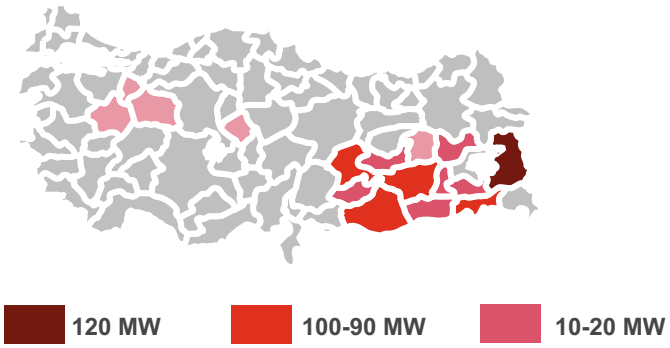
Source: MENR

It is expected that an additional capacity of 2.400 MW will be distributed within the scope of planned YEKA tenders.

Table 20

Planned and Cancelled YEKA Tenders

	YEKA SPP-2 (Cancelled)	YEKA SPP-5 (Planned)	YEKA WPP Offshore (Planned)
Location	Niğde, Hatay, Şanlıurfa	18 Connection Regions	Gelibolu, Bandırma,Bozcaada,Karabiga
Date	-	To be announced	To be announced
Capacity	1,000 MW	1,200 MW	1,200 MW
Ceiling Price	65 USD / MWh	950 TRY / MWh	80 USD / MWh
Winning Bid	-	-	-
Power Purchase Guarantee Period	15 Years	First 23 GWh/MW to be produced	First 50 TWh to be produced
Local Content Ratio	60%	75%	60%



YEKA SPP-5

The YEKA SPP-5 tender, allocated to 18 cities with a total capacity of 1,200 MW, was postponed. Largest allocations were made in Van, Şırnak, Şanlıurfa and Malatya regions with a total capacity of 420 MW. Similar to YEKA SPP-3, the allocations were made into more regions with smaller portions.

The location of 9 candidate for Planned YEKA WPP's are determined, 6 of them are in Kayseri and 3 of them are in Sivas. The location for candidates of Planned YEKA SPP's will be in Çorum and Şanlıurfa.

YEKA WPP Offshore

First announced on June 2018, the tender, allocated to 3 regions (Gelibolu, Saroz, Kıyıköy) with total capacity of 1,200 MW, was postponed due to lack of investor demand. Since the postponement in October 2021, there has been no developments regarding the tender. On August 2023, MENR has announced the size and location of these canditates. According to MENR, Bandırma, Bozcaada, Gallipoli and Karabiga was allocated as a candidate Renewable Energy Resource Area (YEKA) for offshore wind energy.

Source: MENR, Publicly Available Resources

In March 2022, EMRA has announced that unrealized installed capacities from cancelled YEKA tenders and earlier pre-YEKA WPP projects (idle capacities allocated in 2017 wind tenders) have been reallocated to SPPs, WPPs and hybrid power plants. TEİAŞ defined 12 individual regions for new capacity allocations.

Capacity Allocation Regions of TEİAŞ

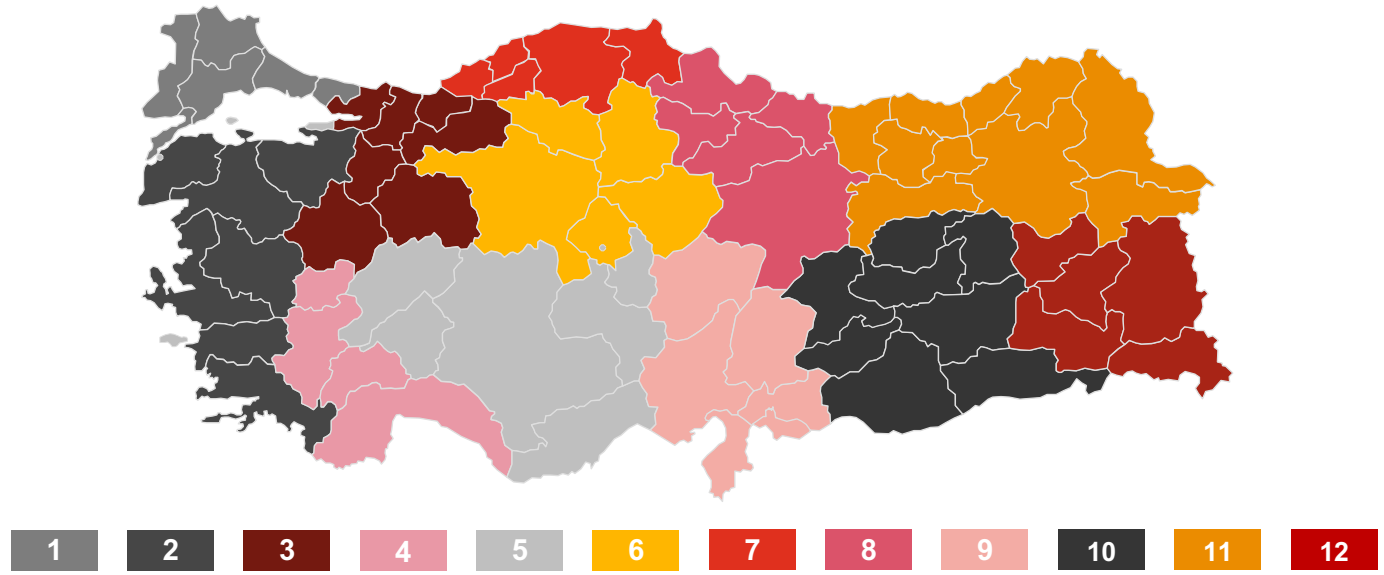


Table 21

Capacity Allocations (2022-2023[1], MW)

MW	Unlicensed			Hybrid			Capacity Increase		
	2022	2023	Total	2022	2023	Total	2022	2023	Total
1	21	15	**36**	30	7	**37**	136	175	**311**
2	31	75	**106**	31	50	**81**	93	-	**93**
3	-	472	**472**	155	150	**305**	19	-	**19**
4	242	210	**452**	216	90	**306**	34	6	**40**
5	39	51	**90**	390	250	**640**	159	-	**159**
6	108	175	**283**	196	-	**196**	33	-	**33**
7	-	40	**40**	5	10	**16**	-	40	**40**
8	-	162	**162**	236	25	**261**	24	-	**24**
9	58	120	**178**	87	30	**117**	145	-	**145**
10	45	600	**645**	118	133	**251**	45	-	**45**
11	20	250	**270**	60	50	**110**	20	-	**20**
12	29	130	**160**	67	5	**72**	29	-	**29**
Total	594	2,300	**2,894**	1,592	801	**2,392**	739	221	**960**

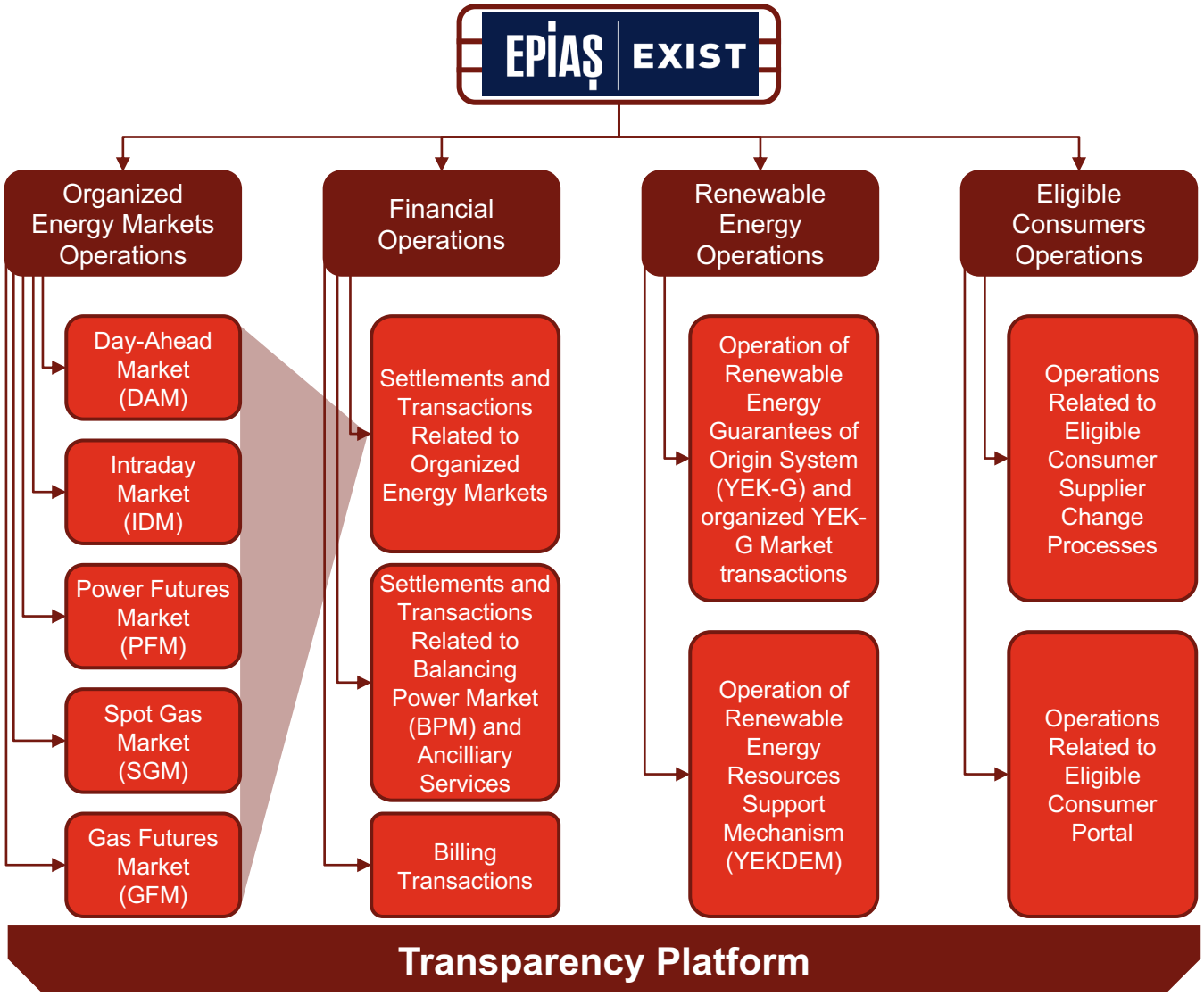
[1]As of June 2023

Source: TEİAŞ, EMRA, Official Gazette

5

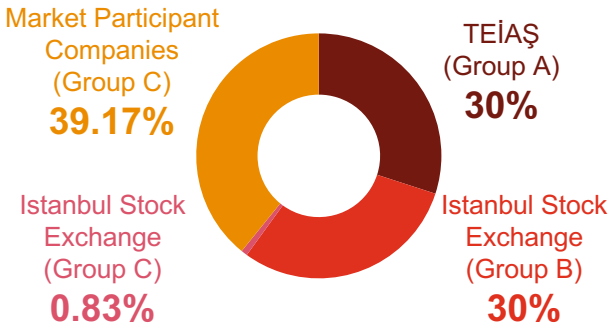
Wholesale Electricity Market

EPİAŞ (EXIST) is the company responsible for ensuring the integrity of the operations in the Organized Energy Markets.



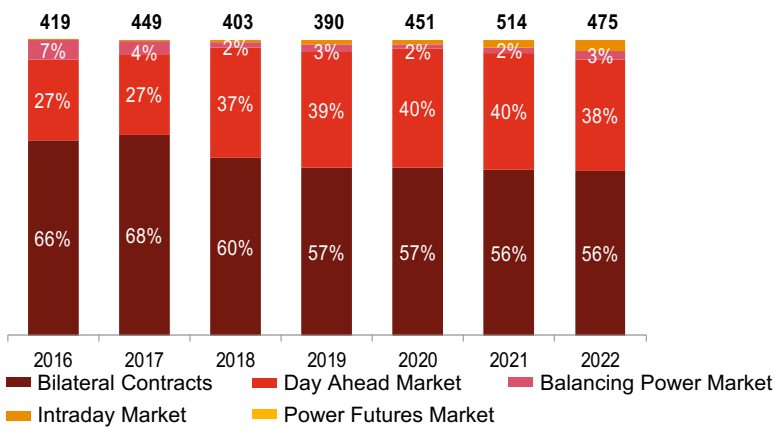
Graph 55

Shareholder Structure of EPİAŞ (%)



Graph 56

Distribution of the Electricity Market Volume (2016-2022, TWh)



Source: EPİAŞ

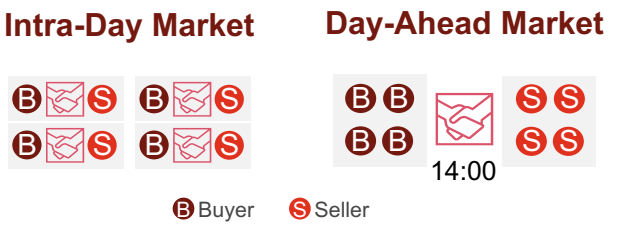
Organized spot markets are used to determine the market price of a given commodity. The intra-day and day-ahead markets are used to determine spot prices for electricity.

3 Organized Spot Markets

The day-ahead market and intra-day markets are two electricity spot markets operated by EPİAŞ. Participation in these markets is not obligatory. Participants have to sign the Day-Ahead Market Participation Agreement and deposit the required guarantee. Participants offer bids that include price and quantity in order to buy or sell electricity from the day-ahead market for each hour of the following day.

The market clearing price (DAMP) and the traded volume are determined for each hour by matching the bids of buyers and sellers. After the day-ahead market closes, participants may supply their needs through the intra-day market

The main difference between intra-day and day-ahead trading is the pricing of the markets:



The intra-day market is a continuous market where orders are immediately executed if there is a matching offer in the opposite direction. Due to its nature, prices fluctuate throughout the day. The day-ahead market determines a uniform market price and clearing volume for all transactions for each hour of the next day.

The day-ahead market has three main purposes:

1. Setting a **reference price** for the electricity market
2. Serving as a **platform** for market participants to conduct electricity **trading and balancing**
3. Facilitating system operation by **providing a balanced** market **one day ahead**.

The supply side can adjust the amount of **generation**, while the **demand side** can fine-tune their **consumption** according to the reference price of electricity.

Day-ahead market features:

1. Participation in the market is **portfolio-based** and each participant is **obligated to balance** their portfolio
2. **Price** is determined for **each hour** of the following day
3. When bidding, the unit used for quantity is lot[1] while TL is used for the price.

[1] Lot: 1 MWh/10.
Source: EPİAŞ

The day-ahead market has three different kinds of offering mechanisms and operates between 9:30 and 14:00 each day.

1) Hourly Offers

Hourly offers place a bid for a specific hour and include a quantity (buy or sell) and a price. The prices are arranged in ascending order. The null values between two consecutive price/quantity levels are determined by the linear interpolation method when the supply-demand curve is formed. The same price cannot be valid for both buying and selling directions.

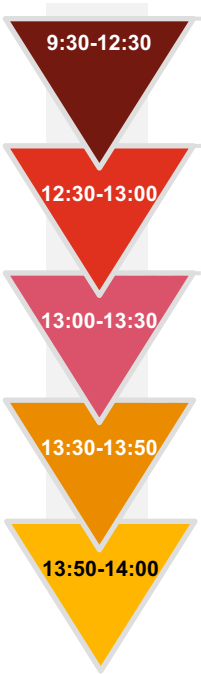
2) Flexible Offers

Flexible offers don't involve a specific hour but only quantity and price. These can only be used to sell electricity. Market participants can give up to 10 flexible offers in a day. Participants have to supply the entirety of the offer in the event of matching.

3) Block Offers

Block offers can be made for more than one consecutive hour. These offers include quantity and price, which are either accepted or rejected for the whole time period. These types of offers have been developed for generation facilities which have black starts that take long time and have high costs. Market participants can give up to 50 block offers in a day.

A maximum of six blocks can be linked together and be at a maximum of three levels. Block offers that are not linked to a block offer are called first level blocks, while block offers dependent on the first level block are referred to as second level blocks. Also, if a block offer is linked to a second block offer it is called a third level block.



Market participants are allowed to make offers for the following day using the online portal.

Market operator checks the security deposits of each participant and approves the offers accordingly.

The optimization tool is used to determine the hourly prices and the traded amount for the next day.

At 13:30, the participants are notified of the approved transactions, to which they may object until 13:50.

Objections regarding the transactions are evaluated and the final results are declared at 14:00.

The price range for all offers is determined to be between 0 to **2,600 TL/MWh**[1]. The price ceiling was implemented with the launch of the day-ahead market. This range is revised by a board decision by EMRA.

For each day, market participants are allowed to make a total of 64 (32 sell /32 buy) hourly offers, 50 block offers and 10 flexible offers.

[1] As of June ,2023.
Source: EPİAŞ

The intraday market acts as a balancing mechanism between the day-ahead market (DAM) and the balancing power market (BPM) and operates throughout the day. Since 2015, the number of transactions continued to increase strongly, mostly due to participants increasing their volume of trading.

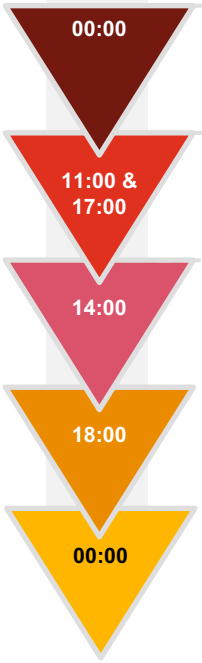
The intraday market was launched on 1 July 2015 **and acts as a portfolio-based organized market with physical delivery requirements.** Transactions are made **using** the continuous trading method and by instant matches. Offers can be **made** up to 60 minutes prior to physical delivery, and can be updated, canceled or disabled.

1) Hourly Offers

Hourly offers can match **completely** or **partially**. The order of offers is important. There are five hourly offer options: active, match if available, match if destroy, timely and completely match or destroy.

2) Block Offers

Block offers cannot be divided and are either accepted or rejected for the whole period. Block offers cover minimum one hour and maximum 24 hours. There are two hourly offer options: active offer and timely offer.



Beginning of the intraday market operations.

Collateral controls are made twice a day before the intraday market opens.

Determination of the day-ahead market price and closure of the day-ahead market

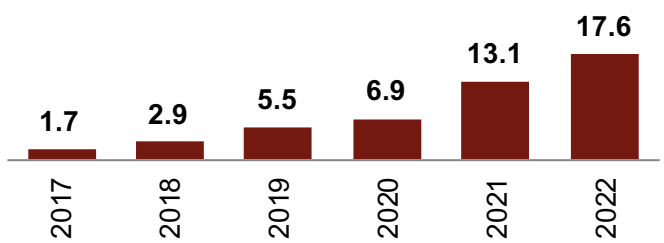
Opening of intraday market contracts for the next day.

Closing of the intraday market operations.

The intraday market operates as a continuous market. However, certain processes, such as bids for the following day, become available after certain hours.

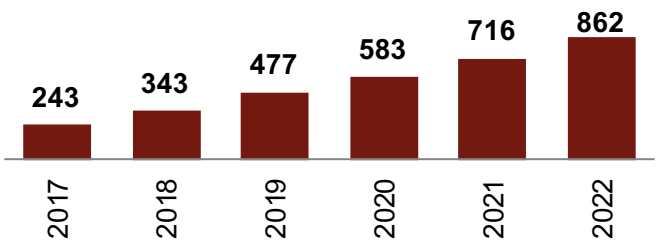
Graph 57

Amount of Total Matched Offers in the Intra Day Market (2017-2022, GWh)



Graph 58

Number of Average Monthly Participants in the Intra Day Market (2017-2022)



Source: EPİAŞ

Physical Electricity Markets

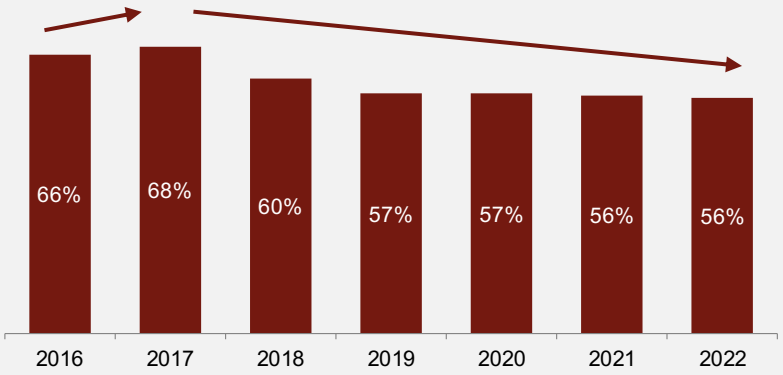
Bilateral agreements allow suppliers and consumers to come to prior agreement on electricity purchase prices.

With the decrease in price predictability in recent years, specifically exchange rate hikes in 2018, the number of bilateral agreements has declined. Many generation facilities began to incur significant losses when selling under predetermined long-term contracts and decided to terminate their contracts, as the termination costs were lower than the losses incurred from these agreements. Buyers whose contracts were terminated had to resort to spot markets. The change in market prices caused losses for both parties, and it resulted in a sharp decrease in the volume of bilateral agreements in the market.

The share of bilateral agreements in the market has decreased more after 2018, as the share of organized spot markets that cover the day-ahead market and intra-day market increased. Although, it is seen that the share of bilateral agreements continued to consist a large part of overall market , it is understood that most agreements are short-termed.

Graph 59

Share of Bilateral Contracts in the Electricity Markets (2016-2022, %)



Source: EPİAŞ

In order to address the problem of unpredictability in the market, which hinders bilateral trading, EPİAŞ launched an organized electricity market that makes forward electricity trading with physical delivery possible.

The Power Futures Market (PFM) was launched on 1 June 2021 as an addition to the existing markets, and it offers long-term, physical delivery. In the new futures market participants may trade directly with EPİAŞ, which removes counterparty risks commonly observed in bilateral agreements. EPİAŞ also provides a daily index price which helps with signaling in the market.

In organized spot markets, market participants can balance their portfolios and perform physical optimization. In the power futures market, participants have the opportunity to hedge against price risk and see price expectations for the future (price discovery). Therefore, spot and power futures markets respond to different needs of market participants and complement each other in this regard.

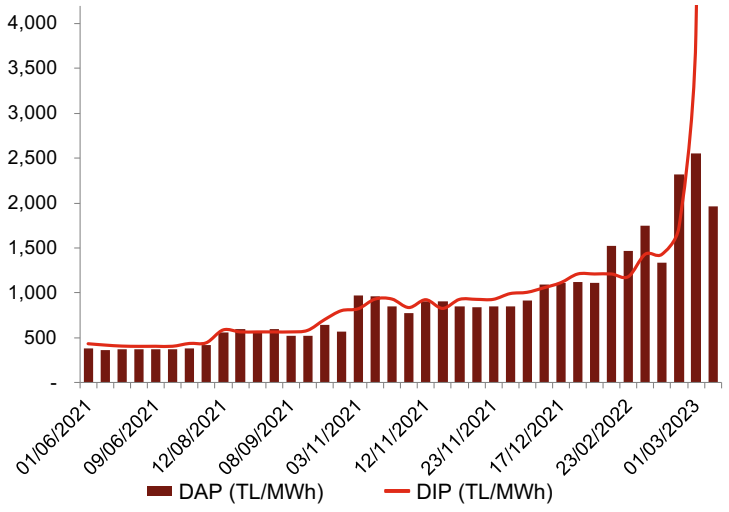
EPİAŞ eliminates counterparty risk in over-the-counter markets by providing a platform that brings the demand side and the supply side together without them meeting physically, and offers assurance to both parties. The most significant feature distinguishing PFM from other markets is the central counterparty role that EPİAŞ undertakes.

PFM contracts are different from bilateral agreements:

- The contracts are standard
- PFM contracts are traded in organized markets
- EPİAŞ provides central counterparty service to parties; there is no counterparty risk and physical delivery and payments are guaranteed
- PFM contracts can be exchanged continuously until the delivery period
- PFM contracts are subject to regulation

Graph 60

Day Ahead Prices and Daily Index Price (TL/MWh)



At the end of each session, for contracts traded the daily index price (DIP) calculated and published through matches in each session's contract, is published. Thus, a price signal contributes to supply security for market participants. Latest contract was issued in July 4, 2023. A significant gap between DIP and DAP can be observed due to market expectations regarding an upward trend in electricity prices.

Source: EPİAŞ

Spot Gas Market (SGM) and Gas Futures Market are established towards the aim of transitioning Türkiye into an international natural gas hub.

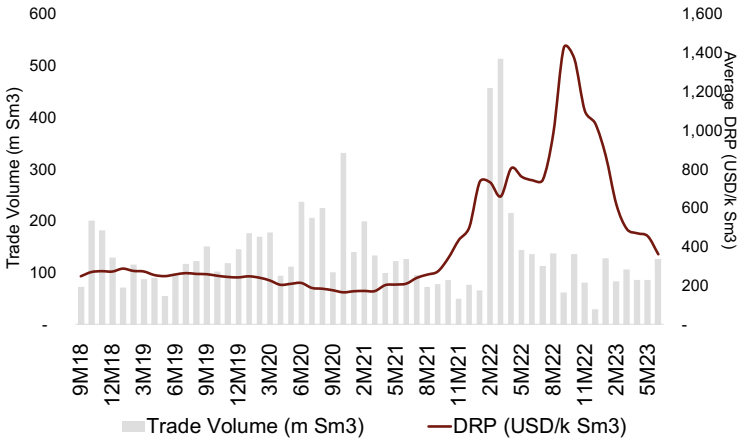
Spot Gas Market

Launched on September 1, 2018, Spot Gas Market (SGM) functions as a continuous trading mechanism and matches appropriate orders instantaneously. As of June 1, 2020, SGM offers both daily and weekly contracts to its participants, enabling them to balance their natural gas portfolios in a more precise manner.

Unlike the OTC natural gas markets, SGM provides standardized contracts between trading parties. Additionally, SGM eliminates counterparty risk observed in all OTC markets since EPİAŞ acts as the central counterparty for both parties involved in a transaction. To further increase the reliability of the market transactions, physical delivery and payments are collateralized.

Graph 61

Daily Reference Price and Trade Volume in Spot Gas Market (USD/k Sm^3, m Sm^3)



- Daily Reference Price (DRP) of day D is calculated as the weighted average of prices regarding all transactions that occurred between day D-1 08.00 and day D+1 08.00.
- DRP gained further significance in addition to being an indicator as BOTAŞ indexed 40% of the tier-2 industry tariff to DRP.

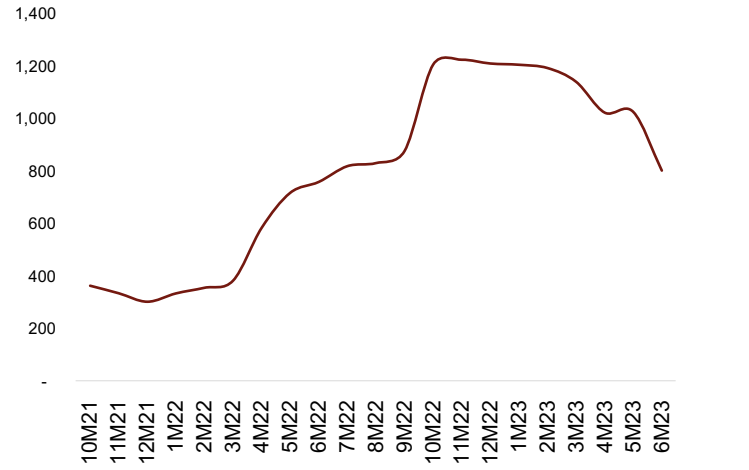
Gas Futures Market

To increase the predictability of gas market, Gas Futures Market (GFM) was launched on October 1, 2021. Similar to SGM, GFM provides standardized contracts, eliminates counterparty risk and all transactions are collateralized. In addition to these features, GFM enables its participants to continuously trade contracts until the delivery period. GFM offers monthly, quarterly and yearly products for its participants.

Source: EPİAŞ

Graph 62

Daily Index Price (USD/k Sm^3)



The balancing power market aims to equalize the total electricity generation with the total amount of electricity consumption in real-time.

The balancing power market is responsible for providing a **reserve capacity** for real-time balancing that can be activated **within a 15-minute time period**.

The market manages the **tertiary frequency control service**. Tertiary frequency control is made via a manual adjustment by the system operators for safe and economical operation of the system.

The minimum offer submitted to the balancing power market is 10 MW. All quoted offers for Loading and De-Loading are expressed in 1 MW and multiples of 1 MW.

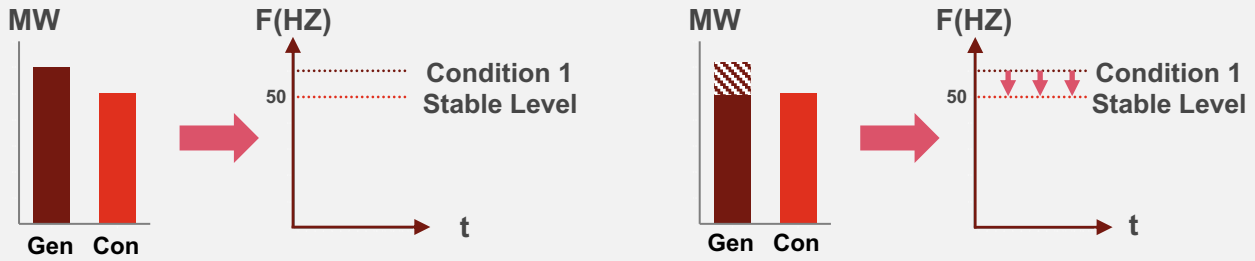
Main Principals in the Balancing Power Market

- According to balancing market regulations "Balancing units that enable taking a minimum of 10 MW up or down within 15 minutes are obliged to participate in the BPM."
- Unlike the DAM and IDM, plant-based operations are performed.
- BPM operations are performed daily, on an hourly basis.

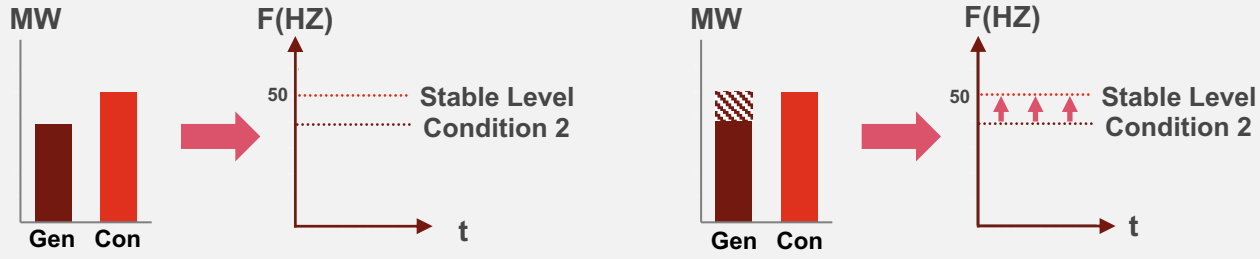
Graph 63

Loading and Deloading Instructions

If the frequency rises above 50 HZ, generation is higher than consumption.
In this case, generation should be reduced, or consumption should be increased.



If the frequency falls below 50 HZ, consumption is higher than generation.
In this case, generation should be increased or consumption should be reduced.



Source: EPİAŞ

Ancillary services are the support services that must be provided by the generation units, and some transmission equipment for the safe operation of the network in real time.

The ancillary services market in Türkiye was introduced in February 2018 with the enactment of the new Ancillary Services Regulation.

The facilities that will provide these services must sign the Electricity Market Ancillary Services Agreement. These legal entities are obliged to make the necessary installations for auxiliary service support.

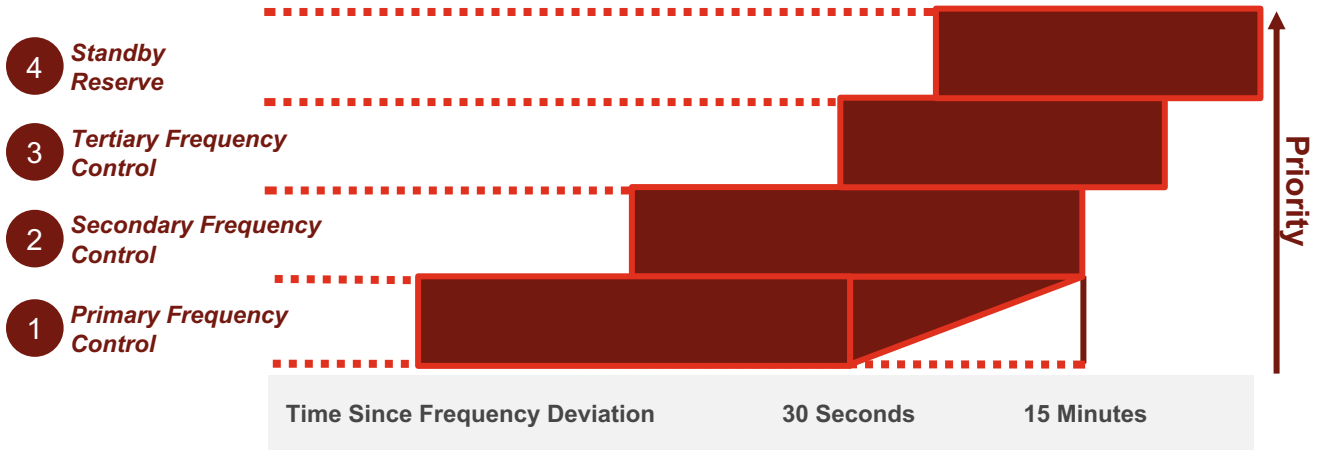
Primary and secondary frequency controls are called automatic frequency controls.

Services defined under ancillary services:

- Primary Frequency Control,
- Secondary Frequency Control,
- Standby Reserves,
- Instantaneous Demand Control,
- Reactive Power Control,
- Regional Capacity Rental Service,
- Black Start.

Graph 64

Operational Reserves Under Ancillary Services



What does each operational reserve do?

1. The primary frequency control starts operating and limits the frequency change.
2. The secondary frequency control becomes active after the primary and brings the frequency back if it is out of the acceptable range.
3. Tertiary comes into play when both the primary and secondary frequency controls are insufficient.
4. The standby reserve is the final source of energy needed for the system to maintain operations. The system uses the minimal amount of energy.

Source: EPİAŞ

The primary and secondary frequency controls are the actively used services in the ancillary services market; however, other ancillary services are defined under legislation, but are not currently utilized.

Primary Frequency Control

The primary frequency control (PFC) service aims to keep active power in balance and to stabilize the system frequency as quickly as possible. The PFC reserve must be available at any time. PFC generators provide a balance between supply and demand automatically and quickly through the speed regulators.

PFC service is procured through tender from generation facilities that meet the required conditions and have passed the test. Units that provide this service must activate within a maximum of 30 seconds and must be able to maintain this power for at least 15 minutes according to the working principle of the units providing primary frequency service.

Secondary Frequency Control

Secondary frequency control (SFC) is a system that TEİAŞ uses to maintain system frequency in cases of excess capacity or demand surplus. It is automatically activated through a central computer algorithm; however it is slower than primary frequency control. It aims to address the potential problems in the electricity system when PFC is insufficient.

The SFC allows the primary reserve power plants to return to their pre-fault operation points and be ready for the next possible fault. This is managed by the automatic system located at the Gölbaşı National Load Dispatch Center of TEİAŞ.

Source: EPİAŞ

Standby (Tertiary) Reserves

Standby reserves are supplied by selected power plants and power plants that do not sell their capacity in bilateral agreements, the day-ahead market or the balancing power market. These power plants are activated and instructions provided if it becomes necessary. A facility that provides standby reserve service must be activated in a minimum of 15 minutes and the offer amount must be a **minimum of 10 MW**.

Instantaneous Demand Control

Instantaneous demand control service aims to prevent the reduction of the frequency mismatch of the system and is provided by consumption facilities.

Reactive Power Control

Reactive power control aims to keep voltage within the range specified in the Transmission System Supply Safety and Quality Regulation.

Regional Capacity Rental Service

The regional capacity rental service aims to ensure reliability and to meet needs in the event of insufficient capacity.

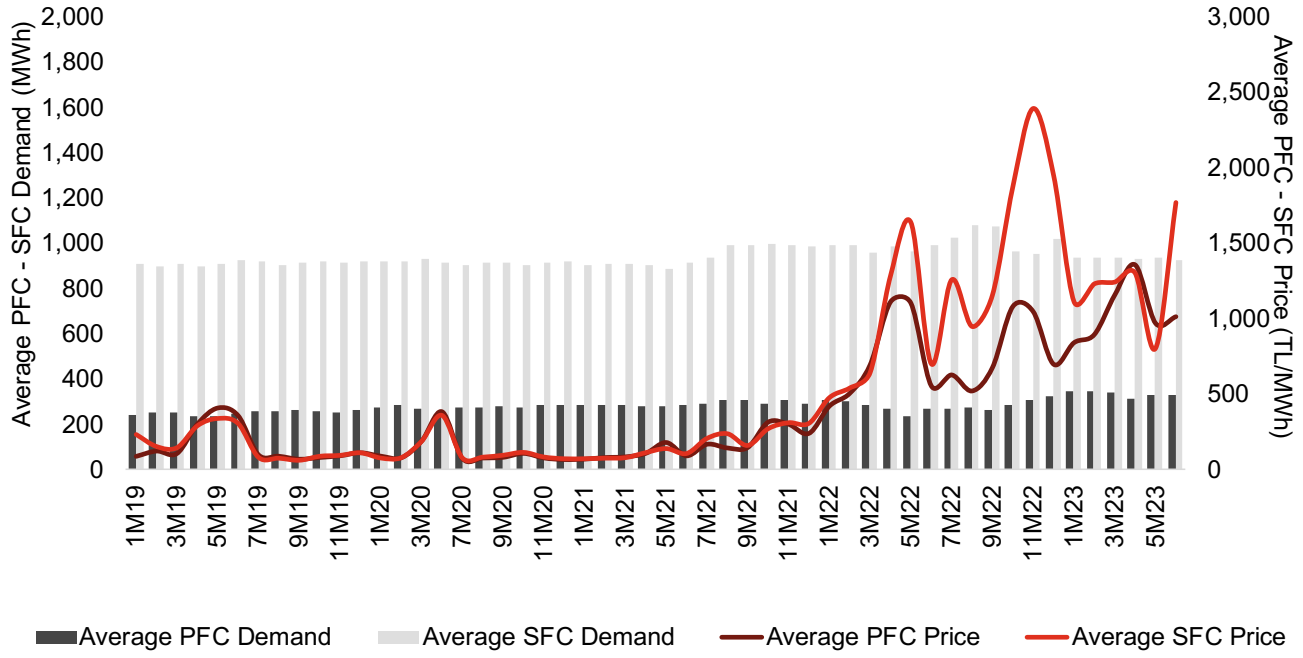
Black Start

Black start is provided by plants that can activate without needing extra energy source.

In line with the new regulation, a daily tender is announced two days in advance for power plants eligible to join the tender (technical requirements related to load increase and shedding time).

Graph 65

Demand and Price of Primary and Secondary Frequencies (2018-6M23)



The winners of the tender are **obliged to generate electricity** in their **set point capacities** and follow any instruction from TEİAŞ regarding **load increase or shedding**. The winners are eligible to receive payment from TEİAŞ, with the amount determined at each SFC auction.

The winners of the auctions are also eligible to join the day-ahead market. Since these plants are obligated to operate at their set point levels in any case, their offers to the day-ahead market are price independent. The potential increase in SFC demand can be expected to apply downward pressure on DAMP by increasing the share of price independent offers in the market.

For the ancillary services market, the day is divided into blocks and there is a separate tender for each block. Demand is determined by TEİAŞ and the price is set at the end of the auction. **There can be a maximum of six blocks for each day.**

Source: EPİAŞ

6

Natural Gas Market

Natural gas plays a crucial role in setting prices in the electricity market. Natural gas prices are affected by a number of factors.

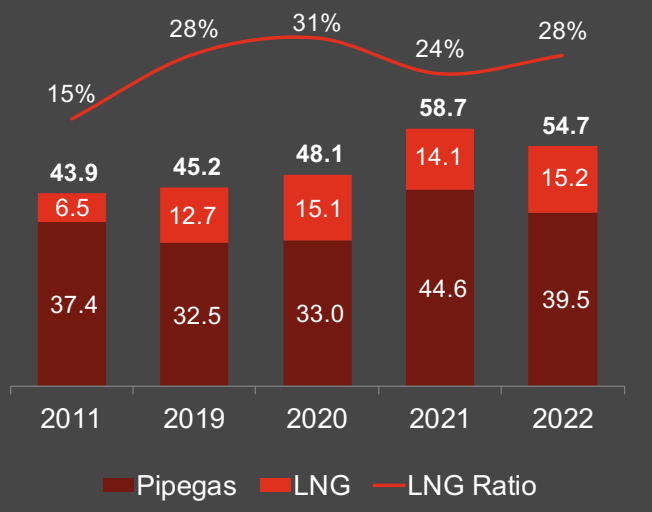
The cost of natural gas plays an important role in determining the short-run marginal costs of natural gas power plants. As such, the cost of natural gas is an important factor in determining price bids in the day-ahead market.

Due to hikes in pipegas prices in 2022, Türkiye started to shift its natural gas supply strategy, increasing LNG imports. In addition, Türkiye undertook required infrastructural investments to better accommodate the increased volume of LNG imports to secure national natural gas supply.

As of May 2023, Türkiye utilizes 3 FSRU ships: Ertuğrul Gazi, the first FSRU of Türkiye, is located in Hatay, Turquise P in İzmir and newest addition Vasant in Çanakkale. Announced on May 7, 2023 BOTAŞ was granted incentives to acquire another FSRU ship.

Graph 66

Imported Natural Gas by Type (bn Sm^3,%)



Türkiye's Strategy Shift in Natural Gas

- Import mainly pipegas from Russia with long-term contracts
- To meet national natural gas demand
- Increase the ratio of LNG and spot contracts
- Import more than national demand to re-export to European countries
- Increased use of storage facilities and FSRUs to accommodate new strategy

Source: BOTAŞ, EMRA

Natural Gas Market Timeline

2001
- Natural Gas Market Law
- Establishment of EMRA

2004
- Regulatory Framework Related to Third Party Access to Transmission Network

2005
- First Contract Release
- Tender, for 4 bcm, to Private Sector

2007
- Re-export NG to Greece
- First Access to Transmission System by Private Sector

2011
- Tariff Regulation for Natural Gas Distribution Companies

2016
- Natural Gas Market Law Amendment (Licensing of Distribution Regions)
- First FSRU Investment by Private Sector

2017
- First FSRU Terminal Started Operating
- First Phase of BOTAŞ Tuz Gölü Storage Facility Started Operating

2019
- Organized Wholesale Gas Trading Platform
- FSRU in Dörtyol started operating

2019
- The European connection of the Trans-Anatolian Natural Gas Pipeline Project (TANAP), the most important link of the Southern Gas Corridor, was opened.

2020
- Turk Stream Natural Gas Pipeline, that will carry Russian natural gas directly to Türkiye and to Europe through Türkiye, was launched.

2021
- Power Futures Market (PFM) was launched.
- Natural Gas Futures Market (GFM) was launched under the country's energy exchange EXIST.

2022
- BOTAŞ changed the calculation method of some natural gas tariffs. Tariff for tier-2 industry users was indexed partially to DRP and the tariff of industrial users operating in metallurgy and petrochemical sectors was completely indexed to DRP.
- Natural Gas Storage facility located in Silivri has reached 4.6 bcm maximum storage volume.
- LNG imports reached an all-time high of 15.2 bcm in 2022.
- Russia declared its intent to transform Türkiye into a natural gas hub for the exports to Europe.
- BOTAŞ increased its tariffs multiple times throughout 2022. Tariff hikes varied between 274% and 599%.

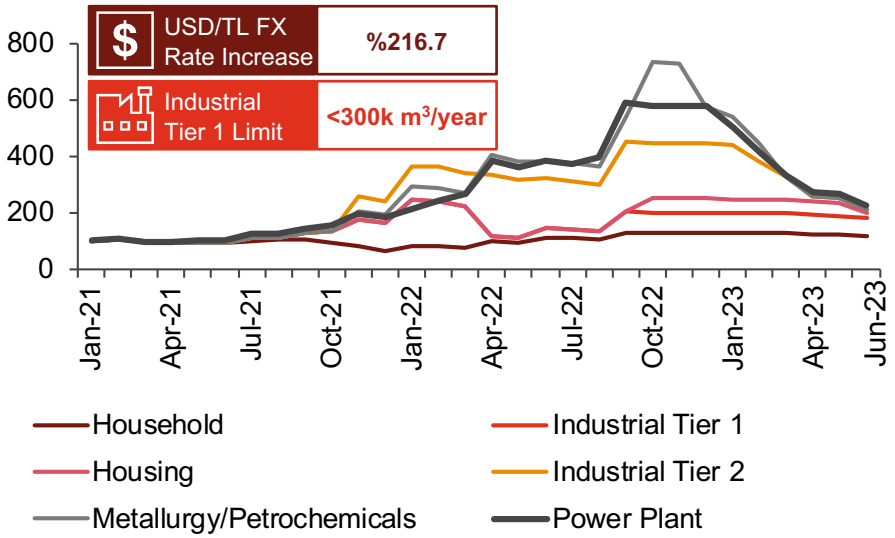
2023
- In line with the goal of becoming a natural gas hub, Export Agreement (1.5 bcm capacity and 13 years term) between Türkiye and Bulgaria was signed on Jan, 2023.
- BOTAŞ signed an Natural Gas Import Agreement with Oman LNG for annual 1.4 bcm volume.
- Natural gas transmission and distribution infrastructure owned by BOTAŞ was damaged by Kahramanmaraş Earthquakes. The amount of damage occurred is estimated to be 827m TL.
- In February, third FSRU of Türkiye, Vasant, started its operations and integrated to LNG facility located in Saros
- Approved in April 2023, Law no.7451 took effect. The new Law envisaged changes regarding market liberalization. One of the most prominent aspects of the Law is the ease of restrictions on long-term import contracts signed by BOTAŞ.
- BOTAŞ was granted investment incentive worth 415m USD for the acquisition of a new FSRU ship.
- Due to the decline in DRP, industrial tier-2 and metallurgy & petrochemical sectors tariffs decreased. Power plant tariff also declined.

Source: BOTAŞ

BOTAŞ tariffs and Daily Reference Price (DRP) observed in Turkish Spot Gas Market increased substantially in 2021 and 2022. With the partial relaxation in the international natural gas markets, tariffs and DRP started to decline in 2023.

Graph 67

Indexed BOTAŞ Tariffs (Jan-21=100)



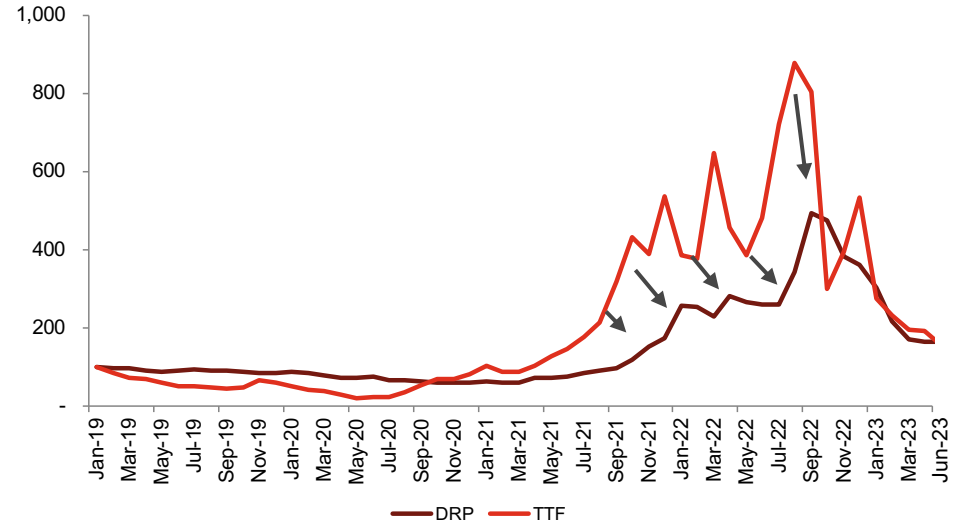
Household tariff remained well below all other tariffs and fluctuation observed is relatively minimal.

As of October 2022, %40 of the industrial tier-2 tariff was indexed to DRP and metallurgy & petrochemical sectors tariff was completely indexed to DRP. Therefore fluctuations observed in these tariffs are larger.

As Daily Refence Price started to decline in late 2022, both industrial tier-2 tariff and metallurgy & petrochemicals tariff decreased and converged to other tariffs. Decline observed in DRP can be linked to price drops in the international natural gas markets such as Dutch TTF.

Graph 68

Indexed Daily Refence Price (DRP) and Dutch TTF (Jan-19=100)



First introduced in September 2018, Daily Reference Price (DRP) is declared by EPİAŞ as indicator for the prices occurred in the Spot Gas Market (SGM) transactions.

DRP of day D is calculated as the weighted average of prices regarding all transactions that occurred in the SGM between day D-1 08.00 am and day D+1 08.00.

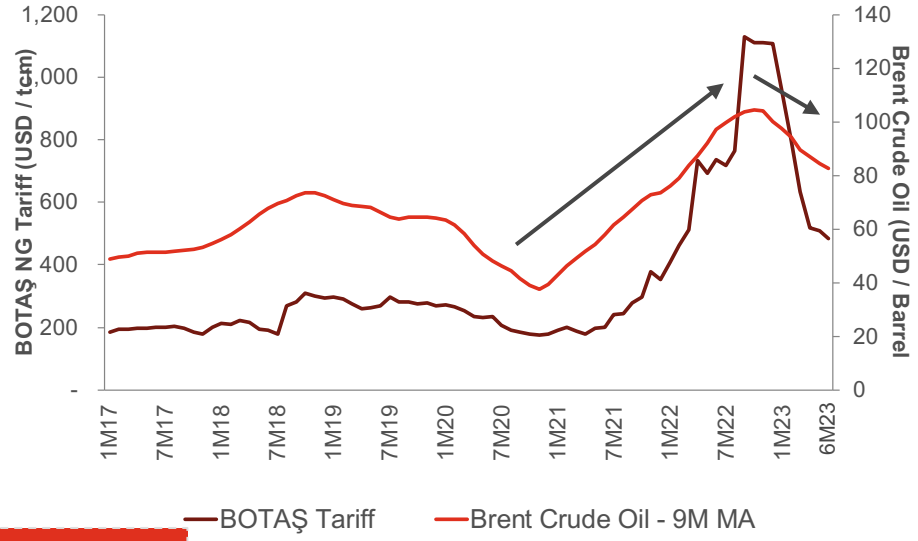
Compared to the indexed prices observed in Dutch TTF natural gas market, indexed Daily Reference Price observed in the Turkish Spot Gas Market is less volatile and reacts to the price changes in the international markets with a lag.

Source: BOTAŞ, Bloomberg, EPİAŞ

BOTAŞ announced the latest price cut for natural gas in the beginning of April 2023 and introduced a 16.7% price cut for natural gas used in electricity generation.

Graph 69

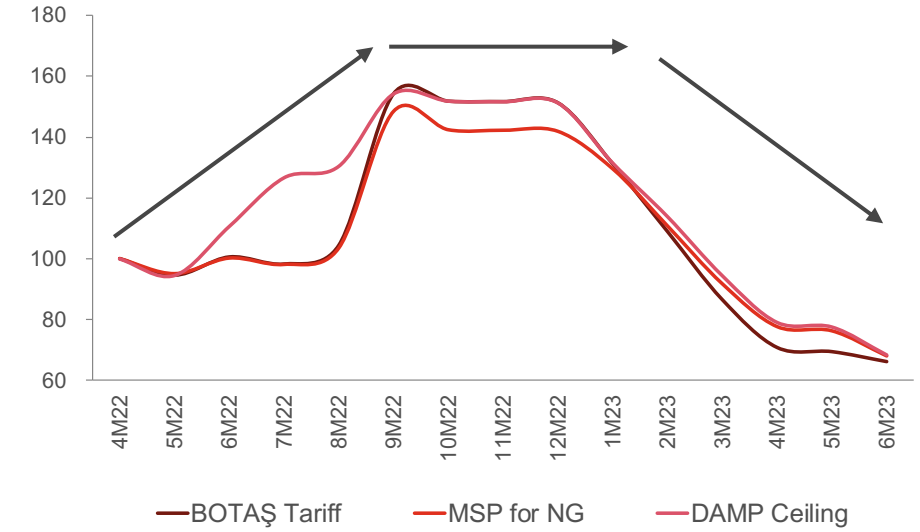
BOTAŞ Natural Gas Tariffs for Power Plants and 9-Month Moving Average of Brent Crude Oil Prices (2017-2023[1])



As a result of the current **9-month lagged** pricing methodology of BOTAŞ due to the manner in which Gazprom contracts are structured, the increase in oil prices in the second half of 2020 and 2021 **has been reflected** on natural gas tariffs in 2021 and 2022. Similarly, the decrease in oil prices starting from the last quarter of 2022 **created downward pressure** on natural gas tariffs in last months.

Graph 70

Indexed BOTAŞ Tariff for Power Plants, Day-ahead Market Price Ceiling and Maximum Settlement Price for Natural Gas Plants (4M2022-6M2023, Apr-22=100)



With the introduction of resource based ceiling price mechanism in April 2022, maximum settlement prices (MSP) for the day-ahead market operations have been implemented.

Due to resource cost of natural gas plants being higher compared to other resources such as coal and renewables, MSP dedicated for NG plants has always been the highest.

BOTAŞ tariff has a direct impact on the prices demanded in the electricity markets by NG plants. Given that MSP structure has ben implemented to ease the burden on plants that rely on fuels, MSP for NG plants always moves in the same direction with the BOTAŞ tariff. A similar positive correlation can also be observed between MSP and ceiling on DAMP.

[1]Data as of June 2023

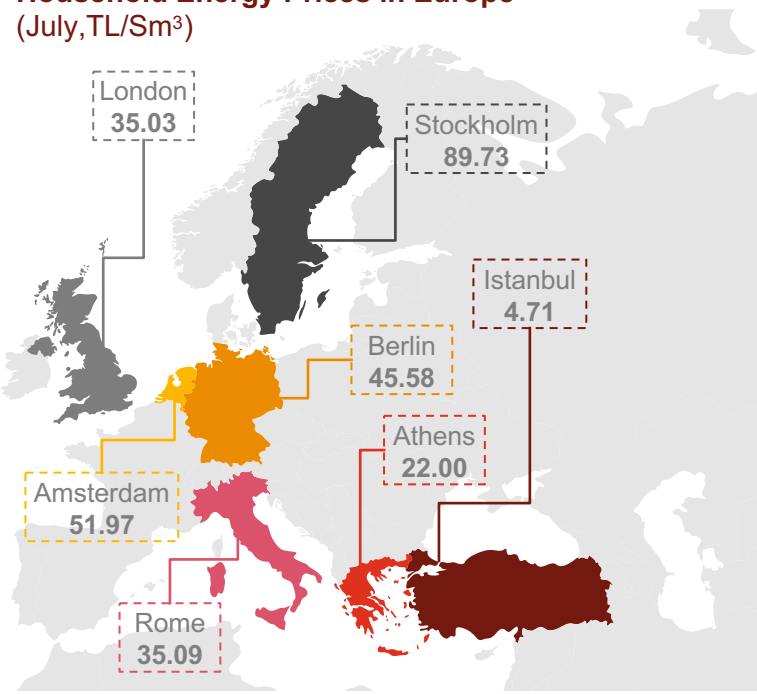
Source: BOTAŞ, World Bank

European natural gas markets have been extraordinarily volatile in the last 2 years.

Natural gas prices in the European markets such as Dutch Title Transfer Facility (TTF), German Trading Hub Europe (THE) and British National Balancing Point (NBP) experienced unprecedented volatility in the recent years. Covid-19 bounce back, climate conditions and a variety of political instances have contributed greatly to the steep price hikes and high volatility. Due to high occupancy rates of natural gas storage facilities and extended use of FSRUs, natural gas prices are currently in decline. However, compared to early 2021 levels, natural gas prices observed in all European natural gas markets are well above those levels.

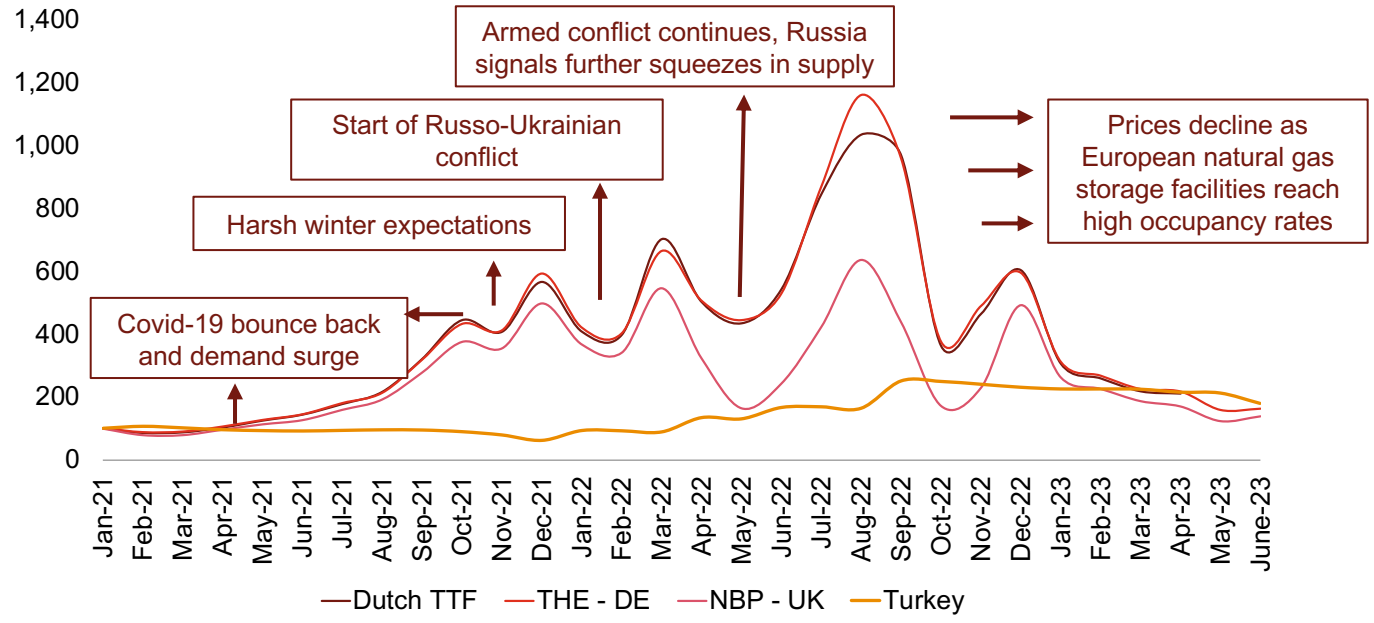
Continuation of Russo-Ukrainian armed conflict, destruction of Nord Stream and Netherlands shutting down Groningen, the largest gas field in Europe, by October 2023 might lead to possible future natural gas price hikes in the European markets.

Household Energy Prices in Europe
(July,TL/Sm³)



Graph 71

Indexed Natural Gas Prices (2021- 2023[1], Jan-21=100)



[1]Data as of June 2023

Source: Bloomberg, Energie-Control, HEPI – Household Energy Price Index, BOTAŞ, İGDAŞ

The total volume of active natural gas contracts in the country is equal to 54.8 bcm (including BOTAŞ and private importers). With the new legislation change in April 2023, BOTAŞ gained more autonomy in its natural gas import activities.

Graph 72

Active Natural Gas Import Agreements of BOTAŞ by Country

Public Importer	Country	Line / Entry Point	Type	Volume (bcm/year)	Date of Agreement	Start Date	End Date
BOTAŞ	Algeria	M. Ereğlisi	LNG	5.40	14.04.1988	1994	Oct. 2024
BOTAŞ	Russia	Blue Stream / Durusu	Pipe gas	16.00	15.12.1997	2003	Dec. 2025
BOTAŞ	Iran	Gürbulak	Pipe gas	9.60	08.08.1996	2001	Jul. 2026
BOTAŞ	Azerbaijan	TANAP	Pipe gas	6.00	25.10.2011	2018	Jun. 2033
BOTAŞ (Spot)	Azerbaijan	Türkgözü	Pipe gas	6.00	19.08.2021	2022	Dec. 2024
BOTAŞ	Russia	Turk Stream	Pipe gas	5.75	30.12.2021	2022	2025
BOTAŞ	Oman	TBD	LNG	1.40	30.01.2023	2025	2034

43.4 bcm of the **48.8 bcm** in natural gas contracts are long-term pipeline contracts, while the remaining **5.4 bcm** is from LNG contracts with Algeria.

In addition to these contracts, BOTAŞ has signed an LNG supply contract with Oman Gaz. The LNG import will start in 2025 with annual **1.4 bcm** volume.

After the 15-year, 6.6 bcm/year agreement with Azerbaijan expired, BOTAŞ signed a three-year gas purchase contract with AGSC for Azeri gas imports from January 1, 2022 to December 31, 2024.

Previously, the legislative framework prohibited BOTAŞ to make new import agreements with the countries that have a currently active natural gas import agreement with Türkiye. Only renewal of the expired agreements with same capacities were allowed.

Approved by Grand National Assembly of Türkiye on April 4, 2023, Law No. 7451 took effect. New legislation enables BOTAŞ to import natural gas in a more flexible manner. Therefore, importing more than the national demand to re-export to Europe became easier for BOTAŞ.

The new legislation change is considered to be a step towards realizing Russia's interest to transform Türkiye into a natural gas hub. Export agreement signed with Bulgaria in January 2023 is another indicator of Türkiye's potential as a natural gas hub supported by Russian gas and its own reserves.

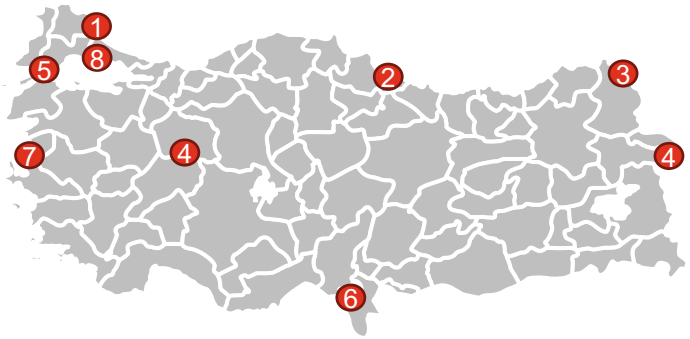
BOTAŞ's natural gas import agreements with Algeria, Russia and Iran end in the period of 2024-2026. These agreements constitute **31 bcm (62% of all contracts)** import volume. With the new legislation, BOTAŞ can secure new import agreements with the countries that have a currently standing agreement, such as Russia, Azerbaijan, Iran, Algeria and Oman.

Source: BOTAŞ, Official Gazette

The focus of Türkiye's natural gas imports moved from Russia to other countries such as Azerbaijan, as well as to LNG suppliers Algeria and Oman.

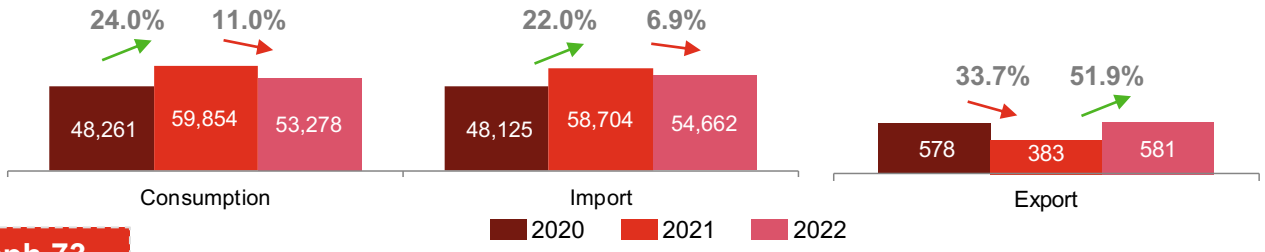
Table 22

Türkiye's Natural Gas Import Routes in 2022



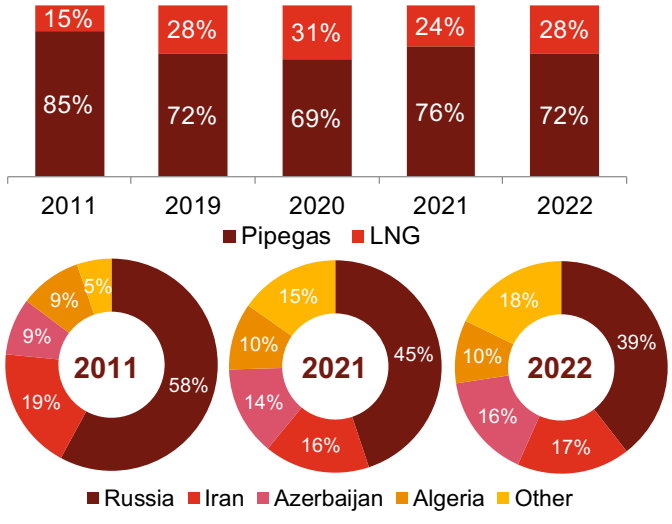
Entry Point	Gas Volume (bcm)	Share (%)
1. Kıyıköy	8.6	15.8
2. Durusu	12.7	23.3
3. Gürbulak	9.4	17.2
4. Türkgözü	2.8	5.1
5. Seyitgazi / Trakya	5.9	10.8
6. Dörtyol FSRU	1.9	3.5
7. Egegaz LNG	4.5	8.2
7. Etki LNG	2.6	4.7
8. BOTAŞ LNG	6.1	11.2
Total	**54.7**	**100**

Compared to 2021 levels, both consumption and imports have decreased in 2022. However, Türkiye imported **1.4 bcm** more than its consumption and used the excess amount to re-export to European countries and fill its natural gas storage facilities.



Graph 73

Imported Natural Gas by Type and Country



LNG prices fell significantly during the Covid-19 pandemic, and this supported an increase of the LNG share of Türkiye's imports. In the second half of the year, this trend reversed due to Türkiye's take or pay obligations in its long-term natural gas supply contracts and the increase of LNG prices in global markets.

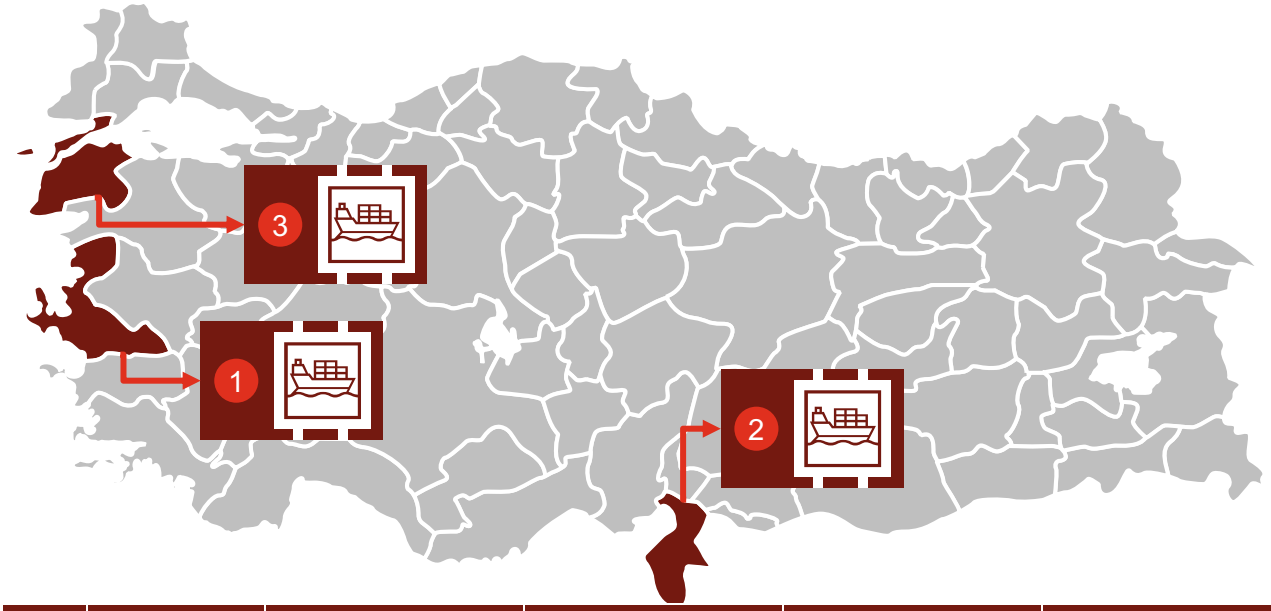
Türkiye has been investing to increase LNG storage capabilities and trying to re-organize the supply side to support the activity in the LNG market. These efforts will have more impact if they are supported by the renegotiation of Türkiye's obligations under current long-term pipe gas supply contracts.

Source: BOTAŞ, EMRA

As of May 2023, Türkiye utilizes 3 FSRU ships: Ertuğrul Gazi, Turquise P and Vasant. These vessels play a vital role in Türkiye's LNG trade and overall natural gas supply.

Table 23

Türkiye's FSRU Ships



No.	Vessel Name	LNG Storage Capacity (cm)	Daily Gasification Capacity (mcm/d)	Stationed in	Status
1	Turquise P	180,000	20.0	Aliağa, İzmir	Owned by Etki, Leased by BOTAŞ
2	Ertuğrul Gazi	170,000	28.0	Dörtyol, Hatay	Owned by BOTAŞ
3	Vasant	180,000	28.0	Saros, Çanakkale	Leased by BOTAŞ
4	n.a.	180,000	n.a.	n.a.	Investment incentives granted to BOTAŞ

As of May 2023, Türkiye utilizes 3 FSRU vessels for its LNG import and export operations. The total LNG storage capacity of these vessels add up to **530,000 m³**. With the recently announced FSRU ship to be commissioned by BOTAŞ, total LNG storage capacity of Türkiye's FSRUs will reach **710,000 m³**. Published in Official Gazette on May 8, 2023, BOTAŞ was granted customs tax and value-added tax exemptions for the commissioning of a new FSRU with **180,000 m³** LNG storage capacity. Total investment incentive amount granted to BOTAŞ is **8.1bn TL (USD 415m)** with **399m TL (USD 21m)** reserved for the equipment imports.

BOTAŞ signing an LNG export agreement **(1.5 bcm capacity and 13 years term)** with Bulgaria is a clear sign that Türkiye will increase its focus on LNG trade by extending its FSRU fleet and storage capacity. As a result of the ongoing Russo-Ukrainian armed conflict and recent natural gas discoveries of Türkiye in Black Sea, Türkiye's role in European natural gas trade is expected to intensify.

Source: BOTAŞ, Publicly Available Sources

Improved storage, diversification of import sources and flexibility in the natural gas network help strengthen Türkiye's position in negotiations with suppliers.

Table 24

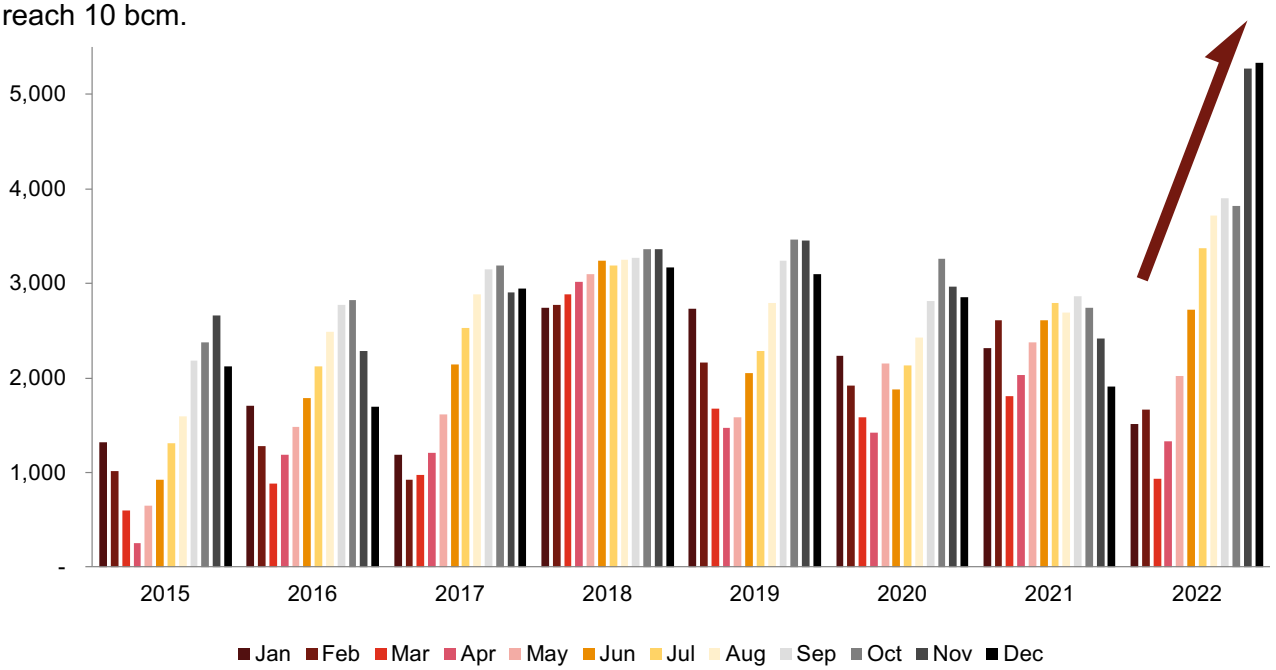
Türkiye's Natural Gas Storage Facilities

No.	Facility Name	Current Capacity (bcm)[1]	Planned Capacity (bcm)
1	Silivri Natural Gas Storage Facility	4.6	4.6
2	Lake Tuz Natural Gas Storage Facility	1.2	5.4
3	Hatay Dörtyol FSRU	0.3	0.3
4	Marmara Ereğlisi LNG Storage Facility	0.3	0.3
5	Egegaz Aliağa	0.3	0.3
6	Etki Aliağa FSRU[2]	0.0	0.0
7	Saros LNG/ Vasant FSRU[3]	0.0	0.0
8	Underground Storage Facilities in Tarsus	n.a	3.0

Graph 74

Natural Gas Stocks at the End of the Month (2015-2022, million Sm^3)

Natural gas stocks reached all-time high of 5.3 million Sm3 in December, 2022. Following expansions planned in the Silivri and Lake Tuz storage facilities, total storage capacity in Türkiye is expected to reach 10 bcm.



[1]Data as of March 2023
[2]Etki Aliağa LNG storage unit has the capacity of 145,000 m^3.
[3]Saros LNG Terminal has no storage capacity and Vasant FSRU located in Saros has the capacity of 180,000 m^3.
Source: EMRA, BOTAŞ

In the recent years, Türkiye has made important natural resource discoveries in the Black Sea. Total amount of discovered natural gas reserve reached 710 bcm with the recent updates and discoveries.

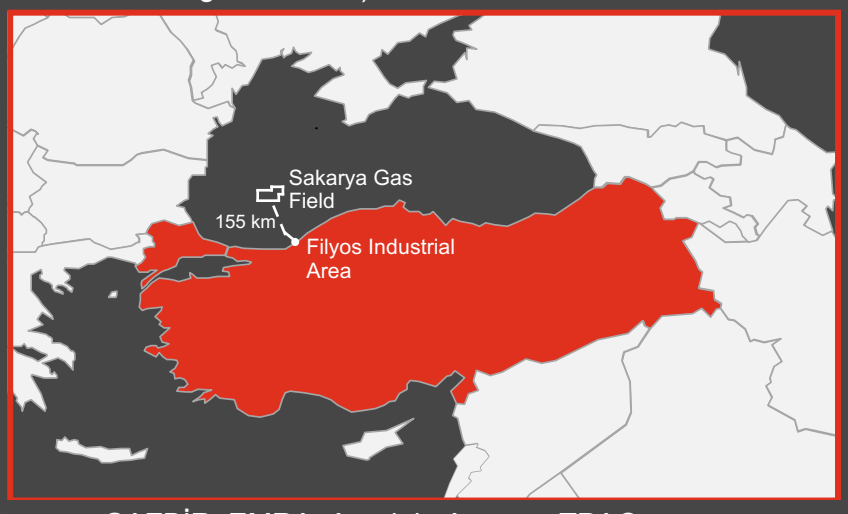
Search for New Natural Resources

Recent Natural Gas Discoveries in Black Sea

2020	Discovery: 320 bcm	Total Reserve: **320 bcm**
2020	Discovery: 85 bcm	Total Reserve: **405 bcm**
2021	Discovery: 135 bcm	Total Reserve: **540 bcm**
2022	Update: 112 bcm	Total Reserve: **652 bcm**
2022	Discovery: 58 bcm	Total Reserve: **710 bcm**

On April 20, 2023, it was announced that first phase of the Black Sea natural gas project is almost completed. It is expected that commercial natural gas production will commence when acceptance procedure of Filyos Natural Gas Processing Facility is finished. Additionally, in the following years more natural gas wells will be incorporated into the production procedure; therefore, it is expected that natural gas processing and production volume will increase gradually. Phase-2 production is expected to start in 2026, and phase-3 is expected to start in 2028 with Amasra. Daily gas production will be 10 mcm Phase-1, 40 mcm in Phase-2, and 60 mcm in Phase-3. In Phase-2, it is aimed to meet all the needs of households in Türkiye with domestic gas.

In line with the discoveries made in last 3 years and aiming to curb the effect of high inflation on households, the authorities announced that households and mosques will be eligible to benefit from free natural gas that is billed between April 24,2023 and May 31, 2023. After the time interval stated above, 25m³ of monthly consumption will be fully subsidized and only consumption above 25m³ will be billed until May 1, 2024 (for the following 11 months).



Source: GAZBİR, EMRA, Anadolu Agency, TPAO

USD 50-55b (2022)
Annual Natural Gas Imports

0.4 bcm (2021)
Türkiye's Annual Natural Gas Production

59.8 bcm (2021)
Türkiye's Annual Consumption

710 bcm (2022)
Total Natural Gas Discovered

USD 1 tn
Total economic value of resources in the Sakarya field

7

Türkiye’s Climate Agenda

The Paris Agreement, European Green Deal, and Glasglow Climate Pact are the 3 most significant initatives at a global level which supports sustainable development with a focus on climate change.

Table 25

Universal Sustainability Agreements

Paris Agreement	European Green Deal	Glasgow Climate Pact
The agreement introduced and adopted at **COP21** held in **Paris** on December 12, 2015, and entered into force on November 4, 2016. The objective is to limit the global average temperature increase to below **2°C**, preferably **1.5°C**, compared to the pre-industrial levels. Countries are establishing the necessary legal frameworks to reduce GHG emissions as soon as possible in order to achieve the long-term temperature target. Countries must submit their National Determined Contributions **(NDCs)**, regarding their targets and plans for achieving the determined commitments • Türkiye declared it's **first NDC** in **2021**, and published the **updated NDC** in **April 2023**.	The European Green Deal, published on December 11, **2019**, is a **roadmap** for the **European Union** to address climate change and environmental challenges. The aim of the agreement is to reduce carbon emissions by **at least 55%** by 2030 and achieve "NZ" carbon emissions by 2050. In order to export to the EU, companies are required to submit their carbon footprint reports, and if they cannot provide the necessary documentation, they will be obligated to pay a carbon border tax starting from 2026. Actions taken after the Deal: • The **introduction** of the **Green Deal Action Plan.** • The **approval** and **implementation** of the Renewable Energy Resource Guarantee **(YEK-G)** System	The climate pack introduced and adopted at **COP26**, held in the **Glasgow** on November 13, 2021. The objective is to limit the global average temperature increase to 1.5°C. The Glasgow Agreement aims to enhance actions on climate and complete the Paris Rulebook. Almost 200 countries agreed the pack, thus started to establish the necessary legal frameworks to reduce greenhouse gas emissions as soon as possible. Altough, there have been new long-term commitments towards Net-Zero made by numerous number of countries, the short-term targets and determined commitments for 2030 remain blurry. • For the **first time**, countries were called upon to **phase down unabted coal power**
Determined Commitments	**Determined Commitments**	**Determined Commitments**
Reduction of GHG Emissions (by 2030) **55%**	Reduction of GHG Emissions (by 2030) **55%**	Reduction of GHG Emissions (by 2030) **55%**
Net Zero Carbon Emissions **2050**	Net Zero Carbon Emissions **2050**	Net Zero Carbon Emissions **2050**
Upper Limit of Global Warmining **2°C**	The share of Renrewables in Electricity Generation **40%**	Cutting the build of new coal power plants

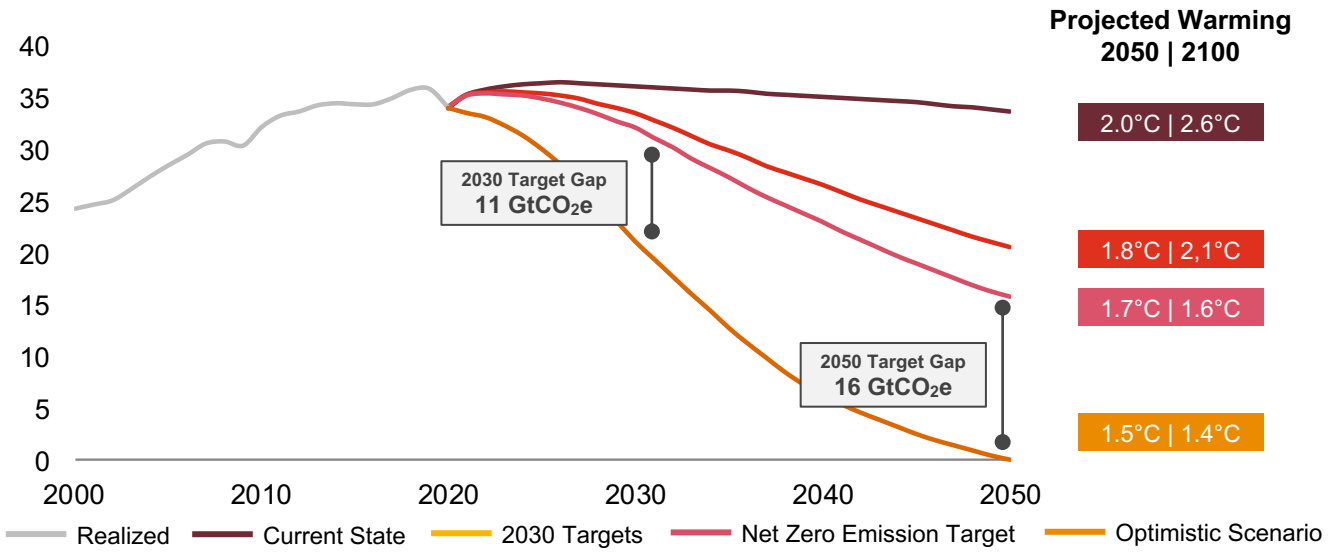
Source: MENR

An inconsistency between the countries that signed Paris Climate Agreement and European Green Deal in terms of their mid-term (2030) and long-term (2050) goals is seen. Even with the complete implementation of the existing plans, it does not quite seem possible to achieve targeted carbon emission levels.

In order to limit global warming to 1.5°C and achieve the necessary decarbonization rates, governments need to revise their nationally determined contributions (NDCs) and take stronger measures. During the COP26, approximately 90 governments have submitted revised NDCs, but not all of them have increased their commitments. It is anticipated that achieving the 2030 targets alone, without significant additional progress beyond that, could limit the warming to 2.1°C by the end of the century.

Table 26

Carbon Emission and Global Warming Expectations (2000-2050)



Current State
It is estimated that the goals currently disclosed and implemented will limit the warming to 2.6°C by the end of the century.

2030 Targets
It is projected that the current 2030 targets (including countries' Nationally Determined Contributions "NDC" as disclosed, excld. long-term commitments) will limit the temperature increase to 2.1°C by the end of the century."

Optimistic Scenario
In addition to disclosed NDCs, if the energy related targets within the framework of the Sustainable Devlopment Goals of countries, are implemented the temperature increase could be limited to 1.6°C by the year 2100. However, this 'optimistic scenario' will only be valid if all targets are implemented."

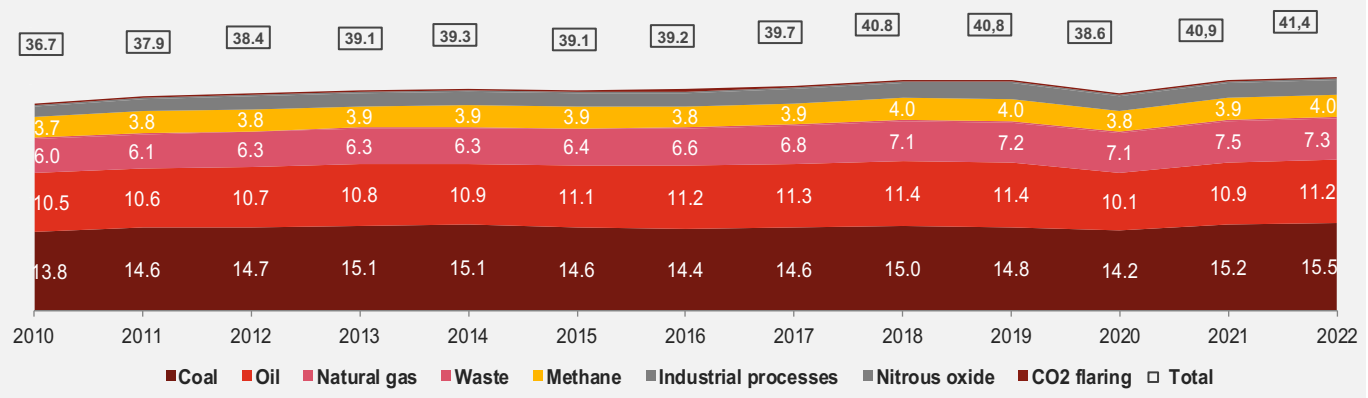
Net Zero Emission Target
With the condition of achieving Net Zero Carbon targets by 2050, it is expected that the global warming will be limited to 1.5°C by 2050 and decrease to 1.4°C by the end of the century.

Source: CAT, IEA

During 2021 and 2022 influenced by many turbulences such as Covid-19, Russia's invasion of Ukraine, energy price shocks and inflationary pressures, global emissions growth turned out to be less than expected.

Table 27

Global Energy Related GHG Emissions ($GtCO_2$)



Targets on Greenhouse Gas Emissions Reduction

Germany's goal is to become GHG neutral by 2045. Germany has set the targets of cutting GHG emissions by at least 65% and 88% by 2030 and 2040 compared to 1990 levels.

The UK announced its more ambitious Net Zero targets in its updated NDC, with a aim of reducing emissions to 68% below 1990 levels.

Spain aims to reduce carbon emissions by at least 31% by 2030 compared to 1990 levels, and become carbon neutral by 2050.

Italy has set a goal to reduce net GHG emissions by at least 50% by 2030 compared to 1990 levels. Coal phase-out from its power mix by 2025.

Hungary aims to reduce carbon emissions by at least 40% by 2030 compared to 1990 levels, and become carbon neutral by 2050.

Poland aims to reduce carbon emissions of by 65% in 2030 compared to 1990 levels, and become carbon neutral by 2050.

During COP, Argentina raised its ambitions on being GHG neutral and decided to reduce the net emission by 27% compared to first NDC submitted.

Brazil commits to reduce its GHG in 2025 by 37%, compared 2005. Brazil, updates its target to increase the reduction by 50% in 2030.

Reducing the share of coal generation focusing on diversification of the power mix by 2030. With the updated NDC, the country aims to reach net zero emissions by 2050.

Aiming to increase renewables to %30 in 2030, and plans to phasing out of coal power plants in 2030.

In order to combat climate change, Netherlands commit to reduce its GHG emissions by 49% by 2030 compared to 1990 levels and a reduction of 95% by 2050.

Mexico commits to a GHG reduction of 40% by 2030, compared to its previous NDC target of 36%.

Source: CAT, IEA

Carbon pricing is a key instrument for increasing climate awareness and supporting green economy by providing an incentive for emissions reductions and low-carbon investments.

Timeline for Carbon Pricing Initiatives

2020

127 countries, **823** cities, **1.541** companies have committed to **decarbonize** their activities by mid-century.

Carbon pricing initatives in world would generate **$53bn** in **revenue** and covered **21.7%** of **global GHG emissions**.

2022

Initiatives would cover **11.66 GtCO2e**, representing **23%** of **global GHG emissions**.

As of **July 2023**, **90+ countries** have committed to **net zero targets** in laws or policy documents.

Future Carbon targets

Carbon prices should increase materially from what is observed in voluntary markets to meet **2°C** temperature goal.

Increasing the **EU's GHG** emission reduction target from **40%** to **55%.**

Main Carbon Pricing Instruments

Emission Trading System (ETS)	Carbon Tax	Offset Mechanism
Caps the total level of GHG emissions and allowed those industries with low emissions to sell their extra allowances to larger emitters. An ETS establishes a market price for GHG emissions.	Directly sets a price on carbon by definition an clar tax rate on GHG emissions or more commonly-on the carbon content of fossil fuels, i.e. a price per tCO_2e.	Designates the GHG emission reductions from project or program-based activities, which can be sold either domestically or in other countries. Offset programs issue carbon credits according to an protocol.

Voluntary Carbon Market in Türkiye

Türkiye ranks **3rd** host country in terms of **registered projects** (**312** as of **August 2022**), and is considered to be the **largest seller of voluntary carbon credits** in its region.

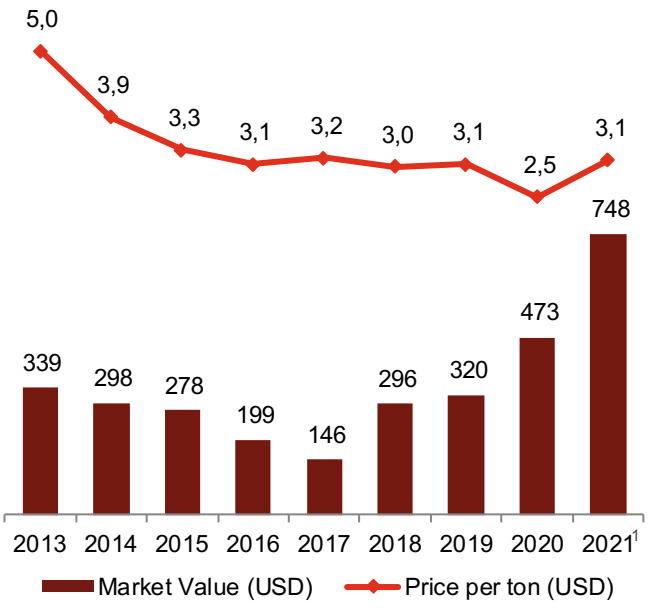
The **Gold Standard** (SustainCERT) and the **Verra's VCS** are the 2 primary standards for which Turkish carbon projects are developed.

Verra's VCS is the **most common** voluntary GHG program/standard, including renewable energy, forestry and others. App. **2,000+ certified VCS projects** have reduced more than **1.1 bilion tonnes of carbon** due to GHG emissions.

As of **August 2022**, Türkiye had **170** projects registered under the **Gold Standard**, and a **142** under the **Verra's VCS**.

Graph 75

Annual Voluntary Carbon Market Overview



Source: World Bank

In April 2023 , Türkiye submitted its NDC which increased the emission reduction target from 21% (2021 update) to 41% reduction from BAU for 2030 based on first NDC submitted in 2015.

Table 28

Türkiye's NDC Targets

	Previous NDC - 2021	Latest Update - 2023
GHG Emission Targets	Up to 21% decrease in Greenhouse Gas emissions from the BAU level by 2030	41% decrease in Greenhouse Gas emissions from the BAU level by 2030
Absolute Emissions Level for 2030 excl. LULUCF	999 MtCO2e	763 MtCO2e
Emissions compared to 1990 and 2010 excl. LULUCF	355% above 1990 emissions by 2030 151% above 2010 emissions by 2030	247% above 1990 emissions by 2030 91% above 2010 emissions by 2030
Determined After	Paris Agreement	Glasgow Climate Pact
Sector Coverage	Economy-Wide	Unchanged
Seperate Target for LULUCF	No	Unchanged
Gas Coverage	All Greenhouse Gases	Unchanged
Seperate Target for LULUCF	Reduction of Emissions from the BAU Levels	Unchanged

Business As Usual (BAU)

The Business-As-Usual scenario (**BAU**) used for its GHG emission reduction target both for 2021 and 2022 NDC is from Türkiye's 2015 INDC (Intended Nationally Determined Contributions). BAU scenario (based on 2015) assumes that few or no measures will be taken to limit GHG emissions.

[1]**BAU:** Business as usual

[2]**LULUCF**: Land Use, Land-Use Change and Forestry

Source: MENR, Climate Action Tracker

8

Electricity Price Analysis

Retail tariffs have sharply increased in 2022 mainly driven by distress in the international energy markets and depreciation on the value of Turkish Lira.

Consistent and relatively mild upward trend observed in retail electricity tariffs after mid-2018 was sustained until early 2022. Although the prices in the day-ahead market increased substantially throughout 2021 both in USD and TL terms as a result of internal and external shocks, hikes imposed on the retail electricity tariffs did not match the magnitude of those observed in DAMP. The main reason why retail electricity tariffs were subjected to such a suppression by EMRA was to curb the effect of electricity prices on the high inflation observed in the Turkish economy.

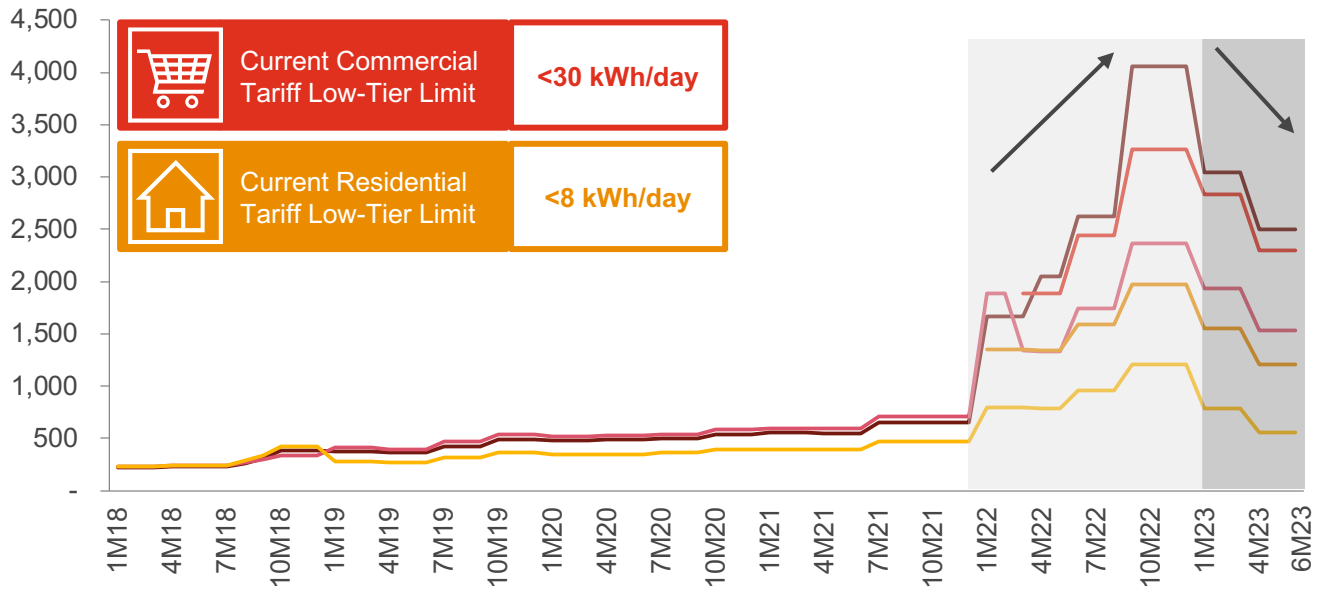
In the early 2022, the suppression imposed on retail electricity tariffs were gradually lifted and all tariffs started their steep upward trend, reaching all-time high levels in TL terms in September 2022.

As the distress in the international energy markets and surge in DAMP continued, EMRA introduced tiered tariffs for residential (January 2022) and commercial (March 2022) consumers to ease the impact of large-scale tariff hikes on smaller-scale users. Upper-bound for low-tier residential consumers was increased twice, in February and March 2022, allowing more and more residential consumers to benefit from lower tariffs.

As the international energy markets started to normalize in 2023, both DAMP and retail electricity tariffs commenced their downward trend. It is expected that downward trend following normalization will be sustained.

Graph 76

Retail Electricity Tariffs (2018-6M23, TL/MWh)



Throughout the last 5 years, residential retail tariff has been the lowest among all of the tariffs and was subjected to least amount of volatility.

Source: EMRA

Consumers who have the right to choose their own electricity suppliers are defined as eligible consumers. Both eligible consumer limit and limit for the supply of last resort tariff is decreasing each year.

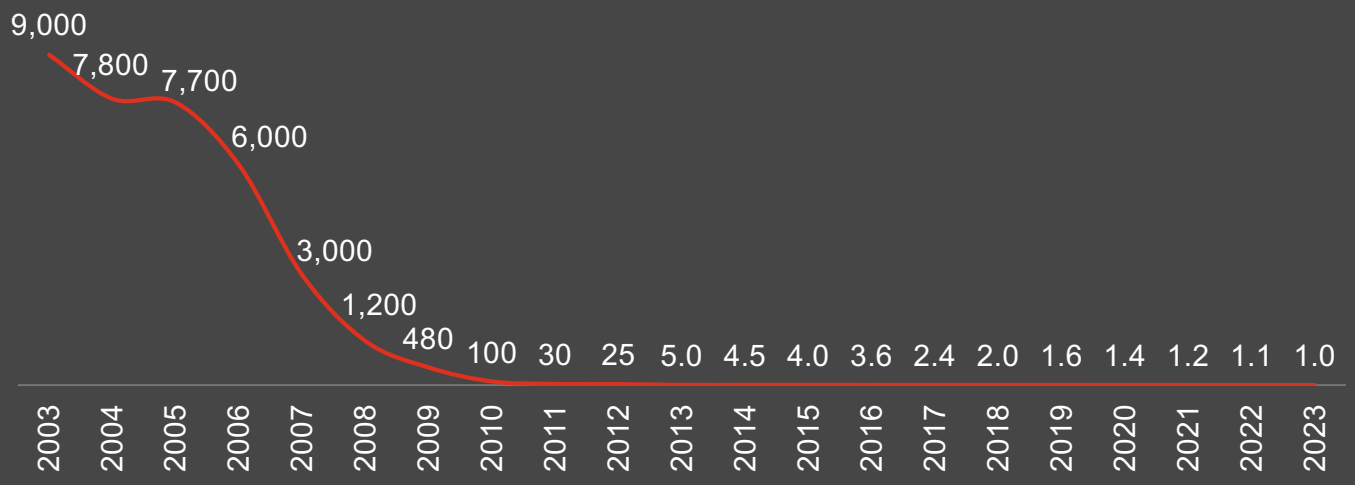
Generation companies and electricity supply (wholesale/retail) companies have the right to sell electricity **directly to eligible consumers**. The unit energy cost for eligible consumers (for those who exercise their right to choose their suppliers) is the price offered by the contracted sales company, while for non-eligible consumers the price is determined by EMRA.

Eligible consumers can exercise their right to choose the electricity sales company which offers the most affordable unit energy cost.

This eligible consumer limit was as high as 9m kWh/year in 2003, and was consistently decreased by EMRA, reaching 1,000 kWh as of 2023.

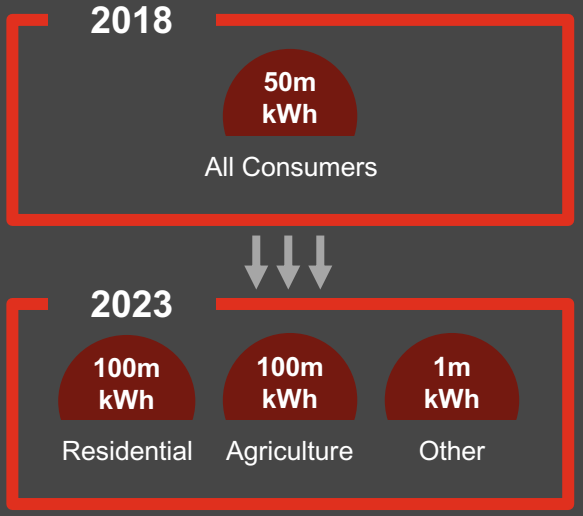
Graph 77

Eligible Consumer Limit (2003-2023, MWh)



The Notification on the Regulation of Supply of Last Resort Tariff was published in the Official Gazette dated **Jan. 20, 2018**. The regulation **concerns large electricity consumers** who choose not to supply their electricity by means of bilateral contracts, even though they are eligible consumers under the current regulation. The consumption limit is determined at the start of each year by the Energy Market Regulatory Authority. Throughout the years, both the classifications and the limits determined for these classifications have been adjusted by EMRA.

Source: EPİAŞ, EMRA



After the decrease of the eligible consumer limit in 2009, purchasing electricity from private suppliers grew in popularity.

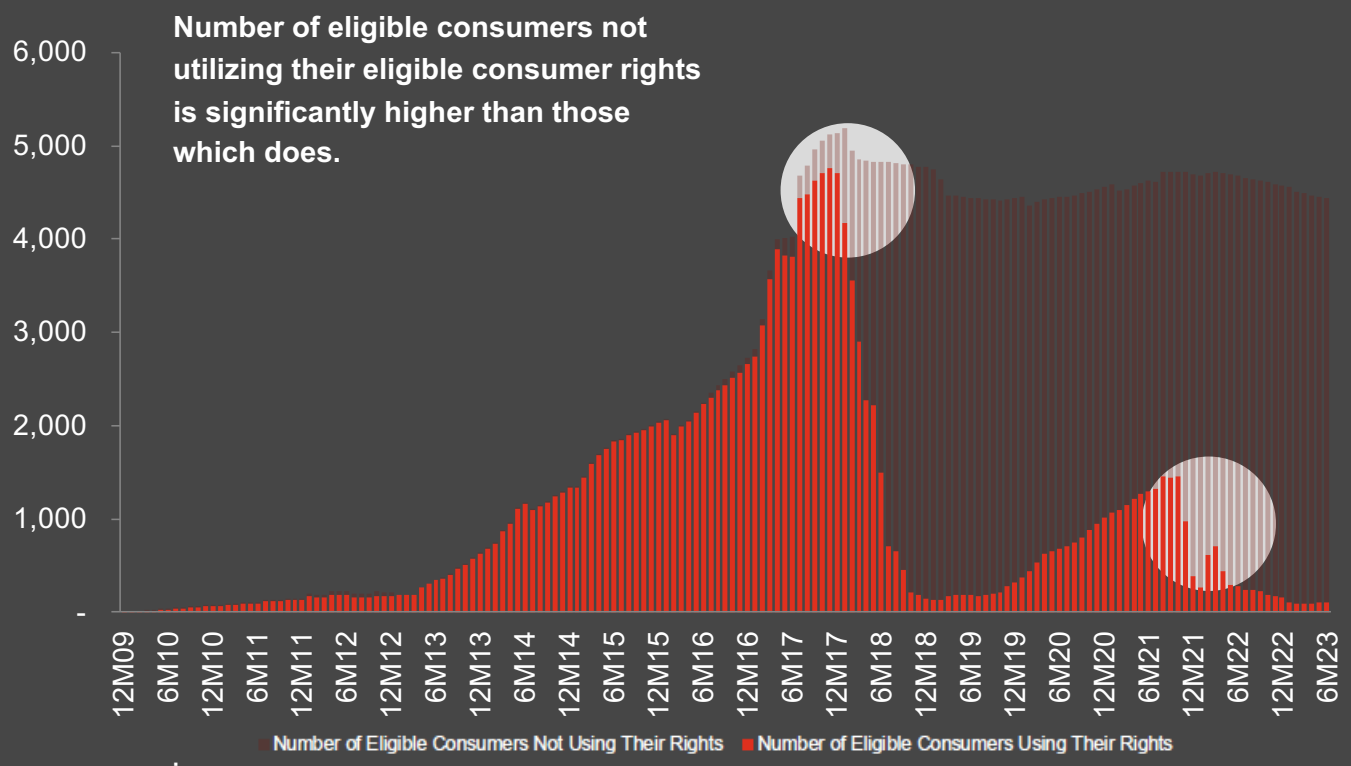
The number of eligible consumers reached an all-time high by the end of November 2017, with 4.7 million consumers buying their electricity directly from private suppliers.

Starting from 2018, suppliers could not meet their obligations to customers because of rising electricity prices. Therefore, they opted to abolish bilateral contracts with their customers, causing a sharp drop in the number of subscribers who utilize their eligible consumer rights. A similar drop has been observed in late 2021, due to sharp FX rate rises leading to a surge in electricity prices.

	Eligible Consumers Using their Right ('000)	Eligible Consumers Not Utilizing their Rights ('000)
Dec-17	4,706	434
Dec-19	323	4,114
Dec-21	386	4,312
June-23	109	4,337

Graph 78

Number of Eligible Consumers (2009-6M23, '000)



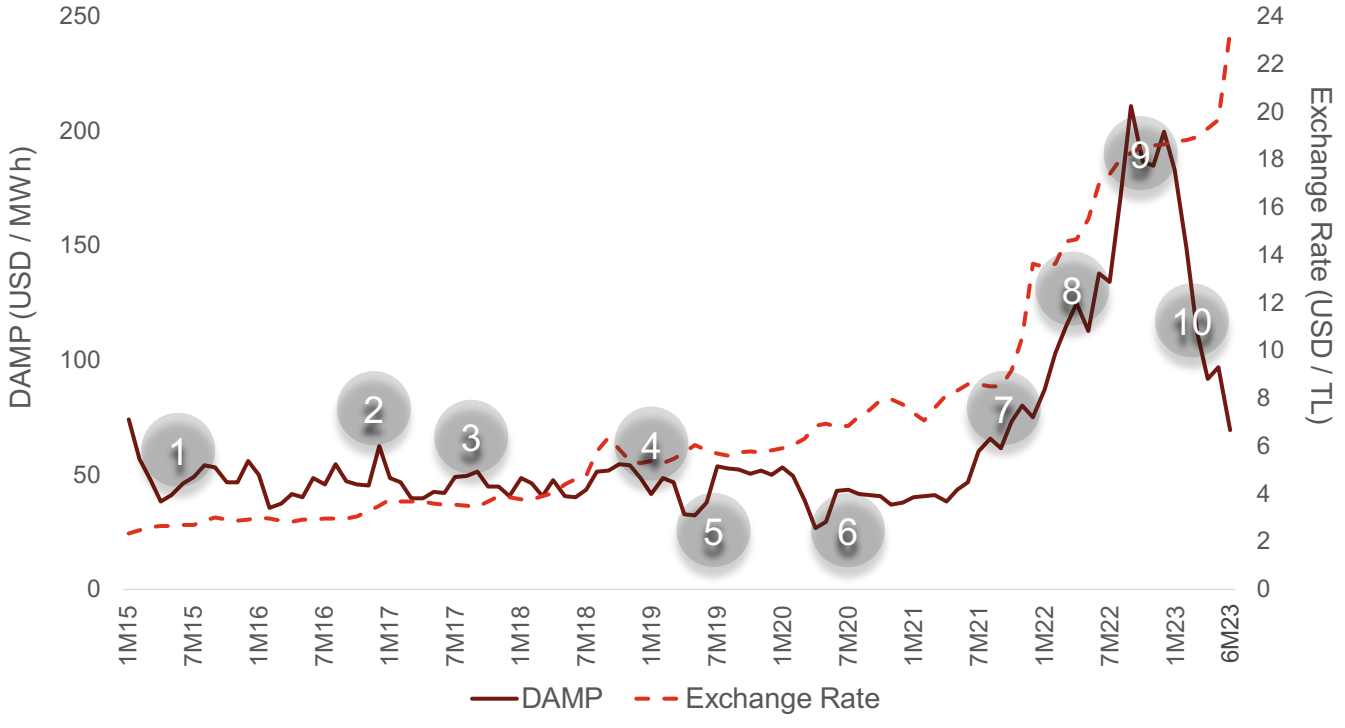
Source: EPİAŞ, EMRA

Several key factors have played a role in the changing DAMP over the years.

1. Excess supply and decreased oil prices, increased price competitiveness of CCGTs
2. Curtailment of the NG supply led to low generation
3. Low rainfall caused a decrease in hydropower generation
4. BOTAŞ increased NG tariffs by 49.5% in TL terms during the FX crisis. DAMP in USD terms remained stable.
5. Unusually high hydro capacity factors and an excessive generation from state-owned generation assets
6. Great demand loss due to the Covid-19 outbreak
7. Post Covid-19 demand increase, severe drought and impact of rising brent oil prices on Gazprom contracts
8. Russo-Ukrainian armed conflict and distress in international energy markets
9. Natural gas prices peak in international markets as Russia signals further squeezes in supply
10. Natural gas tariffs of BOTAŞ for power plants decline as international markets normalize

Graph 79

Evolution of DAMP in USD Terms, (2015-6M23)



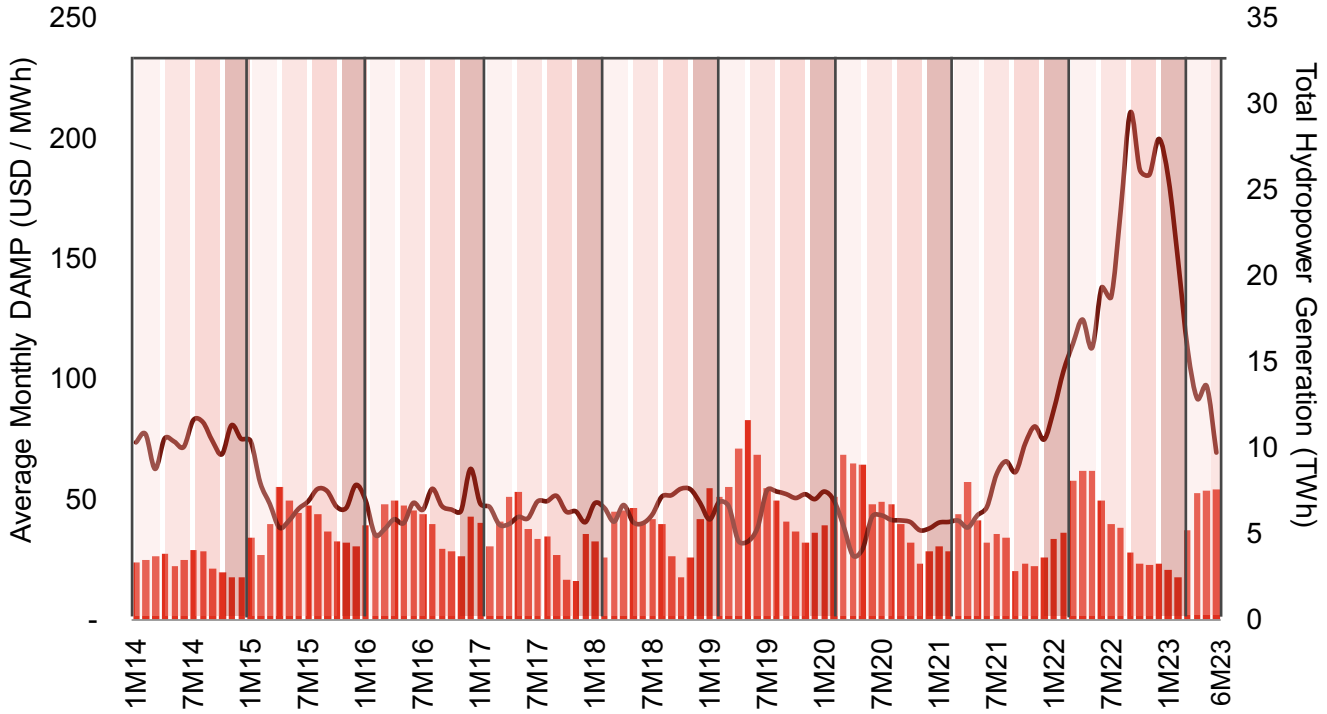
Source: EPİAŞ

In the previous years, DAMP showed strong seasonality caused primarily by hydropower generation. After 2021, the negative correlation has not been as strong as it was before due to other factos impacting the DAMP curve.

While most of the generation facilities experience seasonality to a certain extent, hydropower generation displays a strong volatility caused by the availability of rainfall between each year. There used to be a clear negative correlation between hydropower generation and the DAMP in the previous years. After 2021, due to Covid-19 demand bounce back and international crises such as Russo-Ukrainian armed conflict, DAMP has skyrocketed irrespective of hydropower generation level.

Graph 80

Monthly Day Ahead Market Prices and Hydropower Generation (2014-6M23)



With the rising trend regarding the pumped storage hydropower plants and grid level storage facilities, the impact of seasonality and other harder to predict elements affecting generation is expected to be minimized. Given that both pumped storage and battery storage facilities are included in the third iteration of YEKDEM FiT, these systems are expected to be employed more in the generation, leading to less seasonality and grid imbalance

Source: TEİAŞ, EPİAŞ

Residential electricity prices observed in Türkiye is well below European Union average.

As a result of Covid-19 demand bounce back and distress in the energy markets caused by Russo-Ukrainian armed conflict, electricity prices in Europe have displayed consistent upward trend since early 2021. Residential electricity prices in Türkiye; however, remained relatively stable in EUR terms and below **0.1 EUR/kWh** level.

Table 29

Residential Electricity Price Comparison of Europe and Türkiye[1] (EUR/kWh, 2021-1H22)

Country	1H2021	2H2021	1H2022
Germany	0.32	0.32	0.33
France	0.19	0.20	0.21
Italy	0.23	0.24	0.31
Spain	0.23	0.28	0.31
Netherlands	0.13	0.14	0.05
Türkiye	0.08	0.08	0.09
Belgium	0.27	0.30	0.34
Ireland	0.26	0.30	0.30
Austria	0.22	0.23	0.22
Finland	0.18	0.18	0.19
Portugal	0.21	0.22	0.22
Greece	0.17	0.20	0.21
Slovakia	0.17	0.16	0.18
Luxembourg	0.20	0.20	0.20
Lithuania	0.13	0.15	0.15
Slovenia	0.17	0.17	0.14

The main reasons why residential electricity tariffs in Türkiye behave in such a manner are:

- Residential tariff is always placed **well below** other tariffs such as industry and commercial tariffs to ease the burden on household economy,
- The impact of high inflation observed in Turkish economy and changes in the hard currency FX rates against Turkish Lira are **not fully reflected** on electricity tariffs and less so especially for residential tariffs,
- Large scale depreciation of Turkish Lira observed in the recent years led to the suppression of electricity tariffs in EUR terms.

[1]Price data includes all taxes and levies and covers the tariffs applied for the annual consumption between 2,500 kWh and 5,000 kWh.

Source: EUROSTAT

9

Market Player Analysis

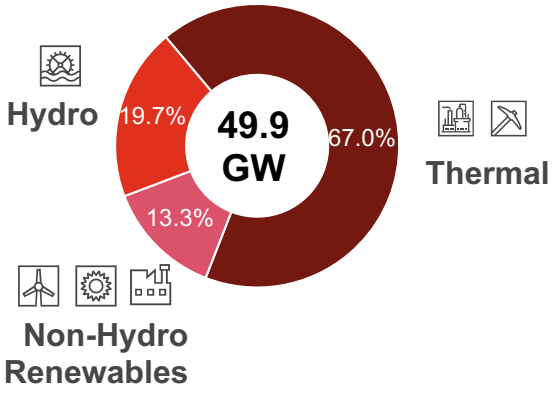
There are currently 17 independent power producers in the electricity generation market that have an installed capacity exceeding 1 GW.

Although the mix of installed capacity has changed significantly since **2014**, the largest source of installed capacity for many of the largest companies continues to be coal and natural gas.

The largest IPPs of Türkiye, illustrated below, accounted for a total of **49.9 GW** of installed capacity in **2023**, which is roughly **47.8%** of total installed capacity. **67.0%** of the installed capacity of **the largest IPPs** is related to thermal energy sources.

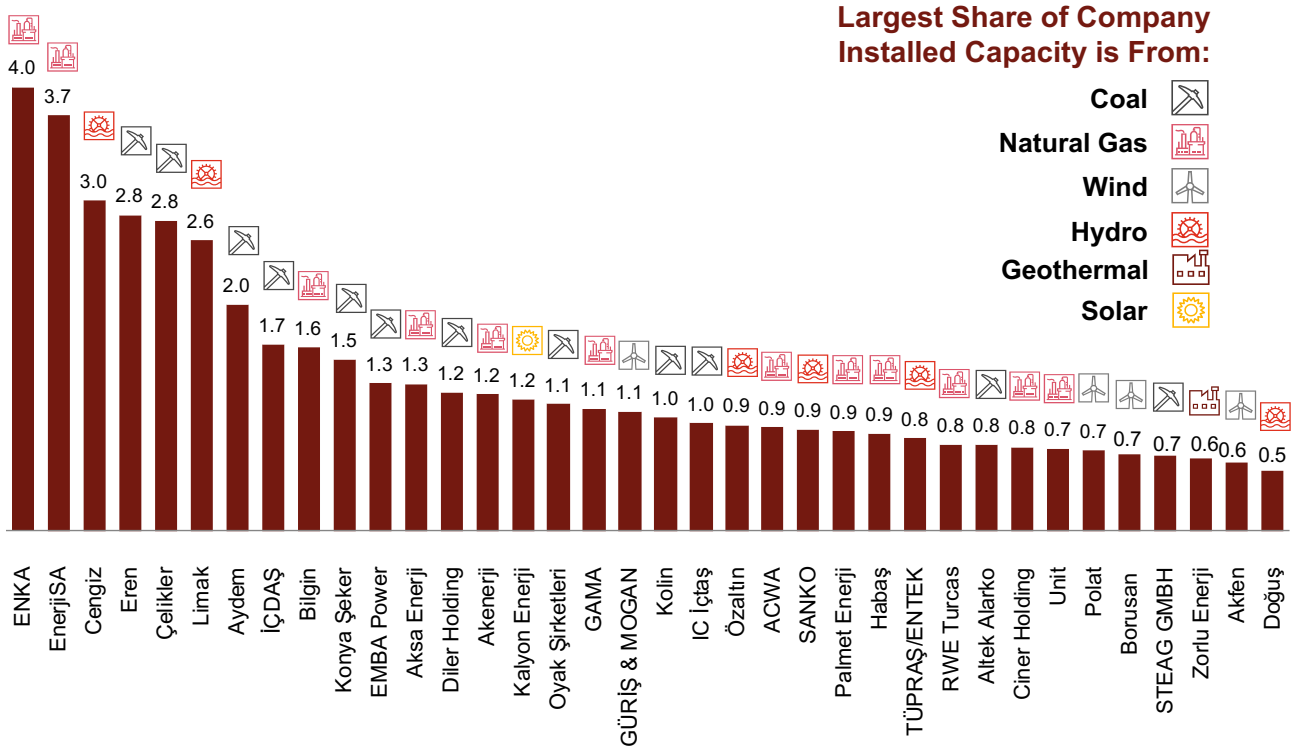
Graph 81

Installed Capacity Breakdown of Largest IPPs (2023)



Graph 82

Largest IPPs by Installed Capacity[1] (2023, GW)



[1]Installed capacities of the independent power producers have been adjusted based on the equity share of their co-owned power plants as of the date of this report. Power plants under construction were not considered as part of the total capacity. The analysis above includes ENKA and the 35 largest IPPs by installed capacity after ENKA.

Source: Publicly Available Sources (2023)

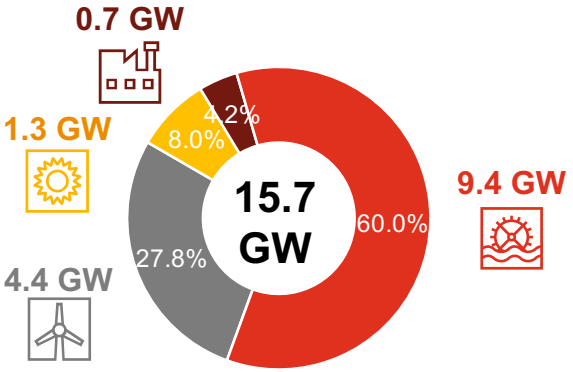
There are 20 companies in Türkiye that have more than 250 MW of capacity based on renewable sources. These companies primarily operate HPPs, with fewer large market players investing solely in wind, solar and geothermal power plants.

The largest companies in terms of installed renewable capacity primarily operate HPPs. For the companies listed below, the share of renewable assets within their total portfolios accounted for **61.1%** of total installed capacity in **2023**. Only a small portion of these companies utilize solar power plants, while several have expanded solely through Hydro and wind power plants.

All of the listed renewable investors below are publicly known to have plans to extend their renewable portfolio with new projects domestically and abroad.

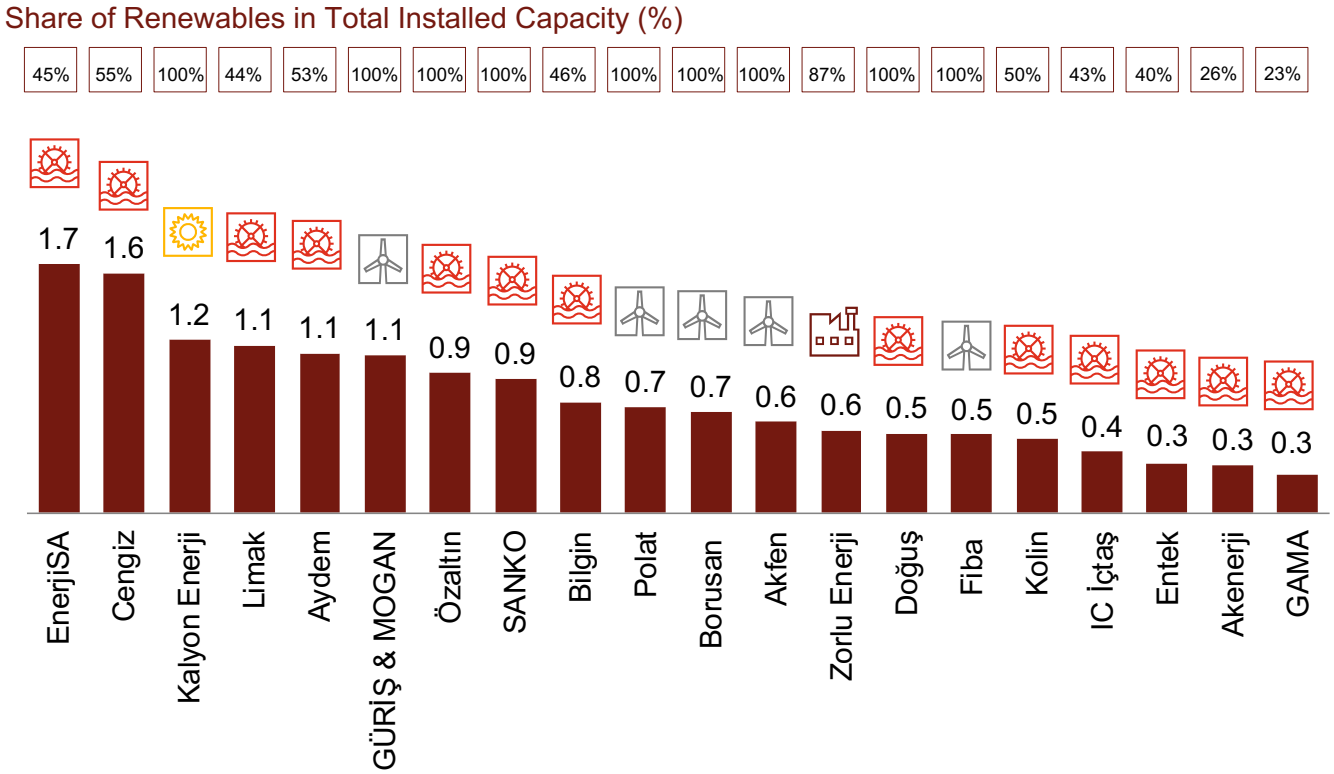
Graph 83

Renewable Capacity Breakdown of 20 Major Renewable IPPs (2023)



Graph 84

Major IPPs by Installed Capacity in Renewables (2023, GW)

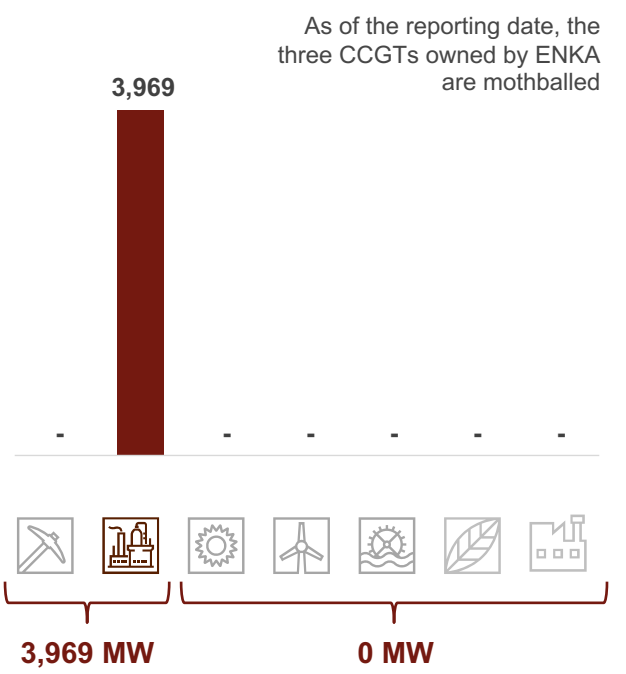


Source: Publicly Available Sources (2023)

ENKA	
Source With Highest Share	Natural Gas
Status	Public Company
Number of Licensed Facilities	3
Installed Capacity (MW)	3,969
Market Share in Turkey (%)	3.8%

Graph 85

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

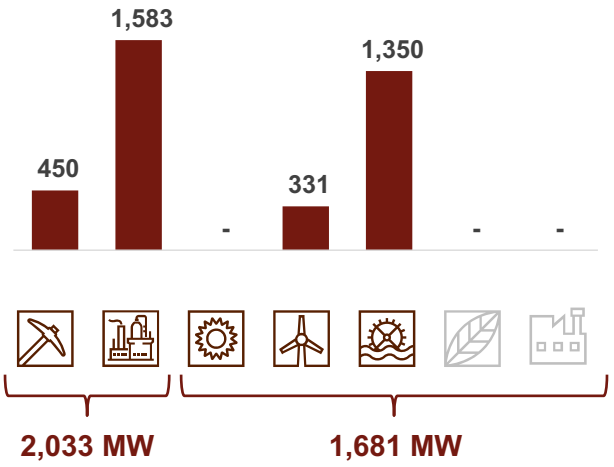
Source: Publicly Available Data (as of May 2023)

ENERJİSA

EnerjiSA Üretim	
Source With Highest Share	Natural Gas
Status	Private Company
Number of Licensed Facilities	21
Installed Capacity (MW)	3,715
Market Share in Turkey (%)	3.6%

Graph 86

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

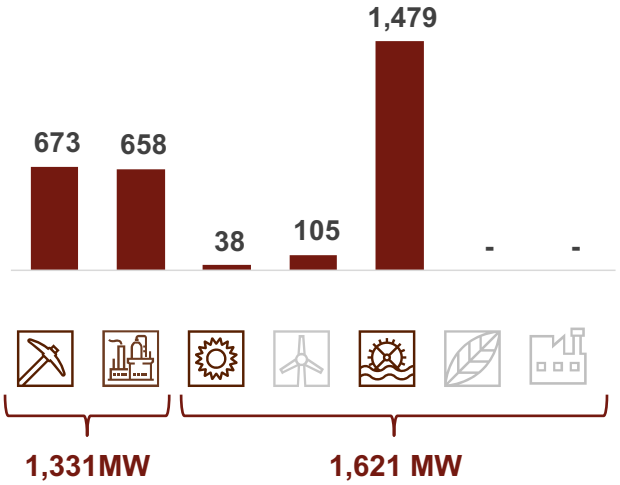
Source: Publicly Available Data (as of May 2023)

Cengiz	
Source With Highest Share	Coal
Status	Private Company
Number of Licensed Facilities	16
Installed Capacity (MW)	2,952
Market Share in Turkey (%)	2.8%

Graph 87

Company Installed Capacity (MW, 2023)

Cengiz owns 50% of the Cenal Karabiga TPP



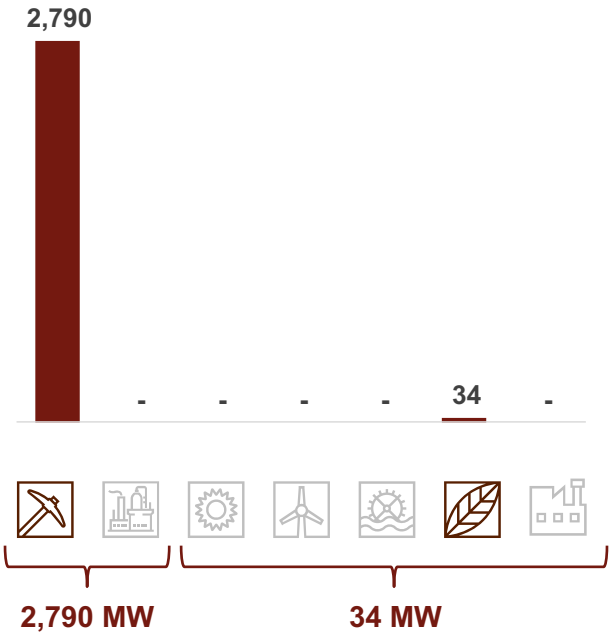
Activities Within Value Chain

Source: Publicly Available Data (as of May 2023)

Eren	
Source With Highest Share	Coal
Status	Private Company
Number of Licensed Facilities	3
Installed Capacity (MW)	2,824
Market Share in Turkey (%)	2.7%

Graph 88

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

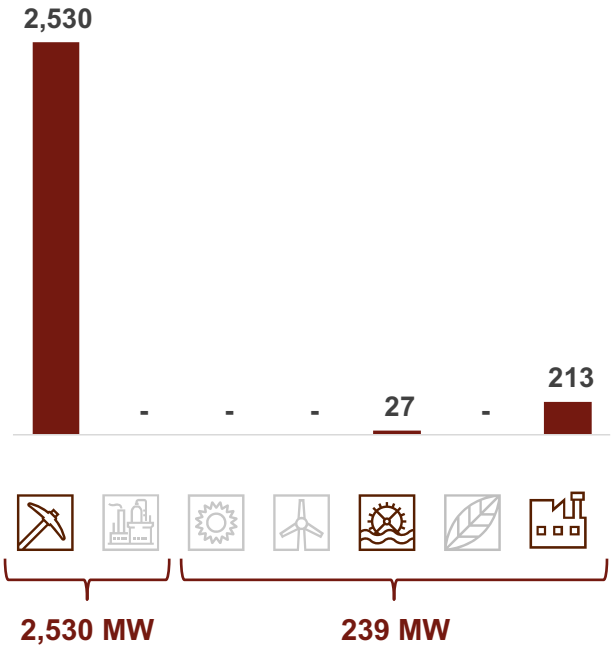
Source: Publicly Available Data (as of May 2023)

ÇELİKLER

Çelikler Holding	
Source With Highest Share	Coal
Status	Private Company
Number of Licensed Facilities	12
Installed Capacity (MW)	2,769
Market Share in Turkey (%)	2.7%

Graph 89

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

Source: Publicly Available Data (as of May 2023)

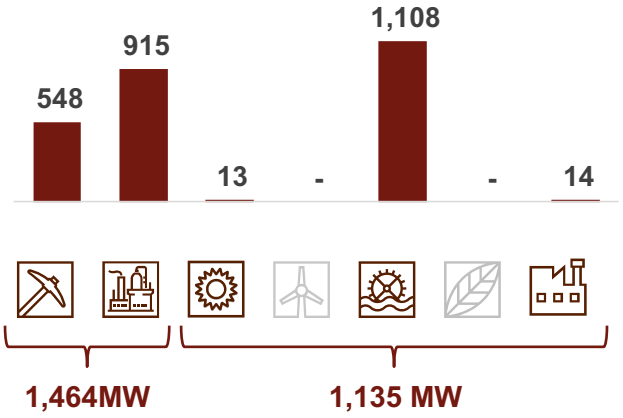
Limak Enerji
Sizin Enerjiniz

Limak	
Source With Highest Share	Hydroelectric
Status	Private Company
Number of Licensed Facilities	14
Installed Capacity (MW)	2,597
Market Share in Turkey (%)	2.5%

Graph 90

Company Installed Capacity (MW, 2023)

Limak owns 50% of the Kemerköy and Yeniköy TPPs



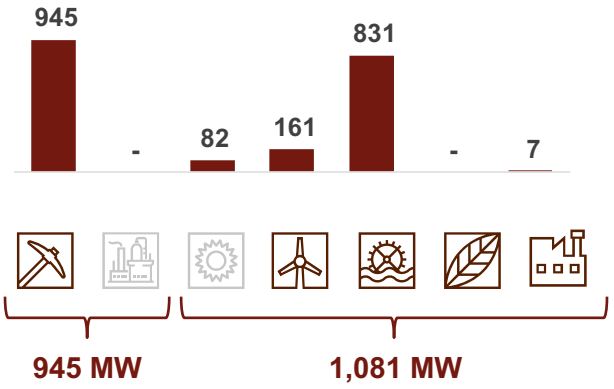
Activities Within Value Chain

Source: Publicly Available Data (as of May 2023)

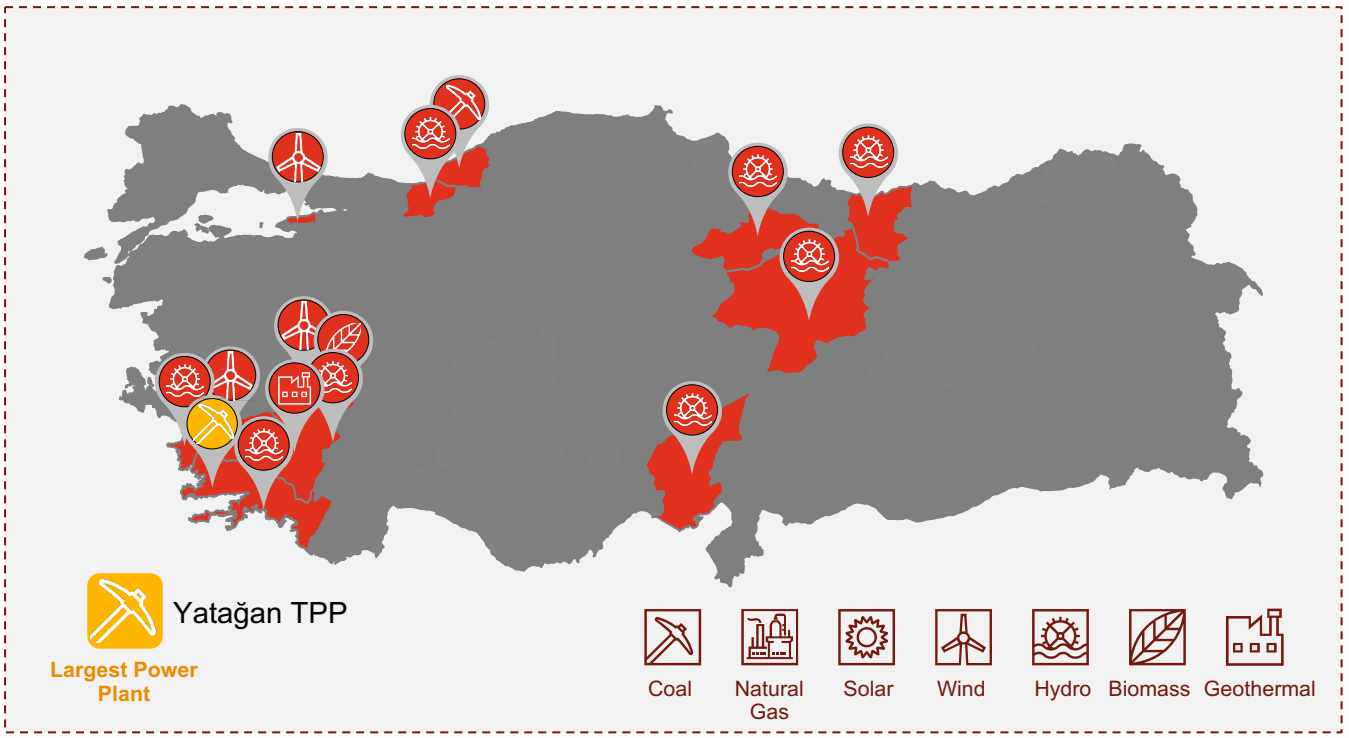
Aydem	
Source With Highest Share	Hydro
Status	Private Company
Number of Licensed Facilities	25
Installed Capacity (MW)	2,025
Market Share in Turkey (%)	1.9%

Graph 91

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

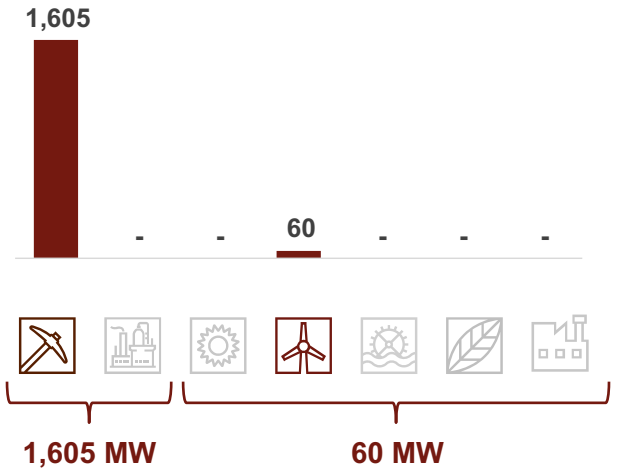


Source: Publicly Available Data (as of May 2023)

İÇDAŞ
ÇELİK ENERJİ TERSANE VE ULAŞIM SANAYİ A.Ş.

İÇDAŞ	
Source With Highest Share	Coal
Status	Private Company
Number of Licensed Facilities	3
Installed Capacity (MW)	1,665
Market Share in Turkey (%)	1.6%

Graph 92
Company Installed Capacity (MW, 2023)



Activities Within Value Chain

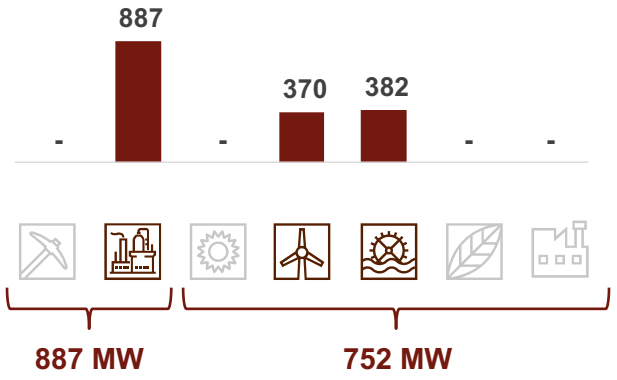
Source: Publicly Available Data (as of May 2023)

BİLGİN ENERJİ

Bilgin Enerji	
Source With Highest Share	Natural Gas
Status	Private Company
Number of Licensed Facilities	13
Installed Capacity (MW)	1,639
Market Share in Turkey (%)	1.6%

Graph 93

Company Installed Capacity (MW, 2023)



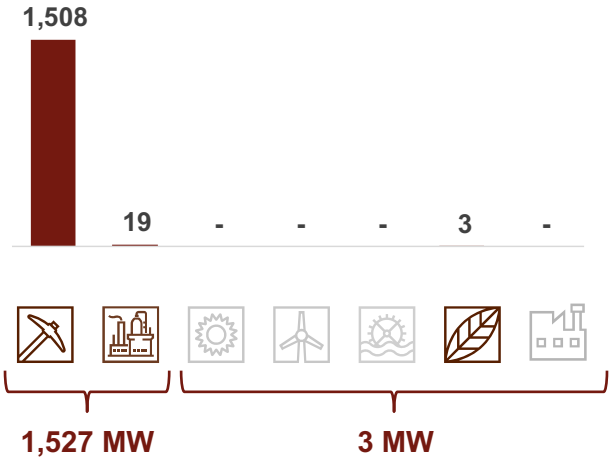
Activities Within Value Chain

Source: Publicly Available Data (as of May 2023)

Konya Şeker	
Source With Highest Share	Coal
Status	Private Company
Number of Licensed Facilities	2
Installed Capacity (MW)	1,529
Market Share in Turkey (%)	1.5%

Graph 94

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

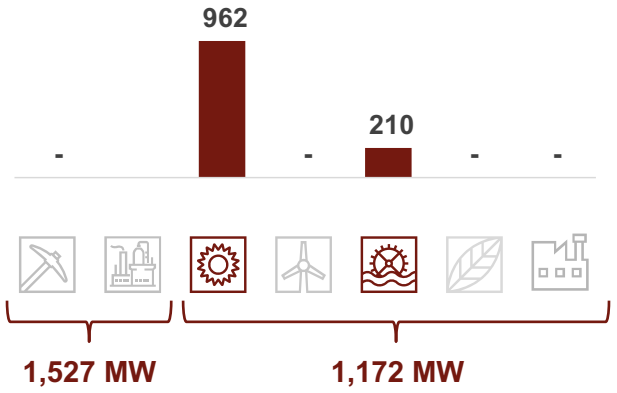
Source: Publicly Available Data (as of May 2023)

kalyon enerji

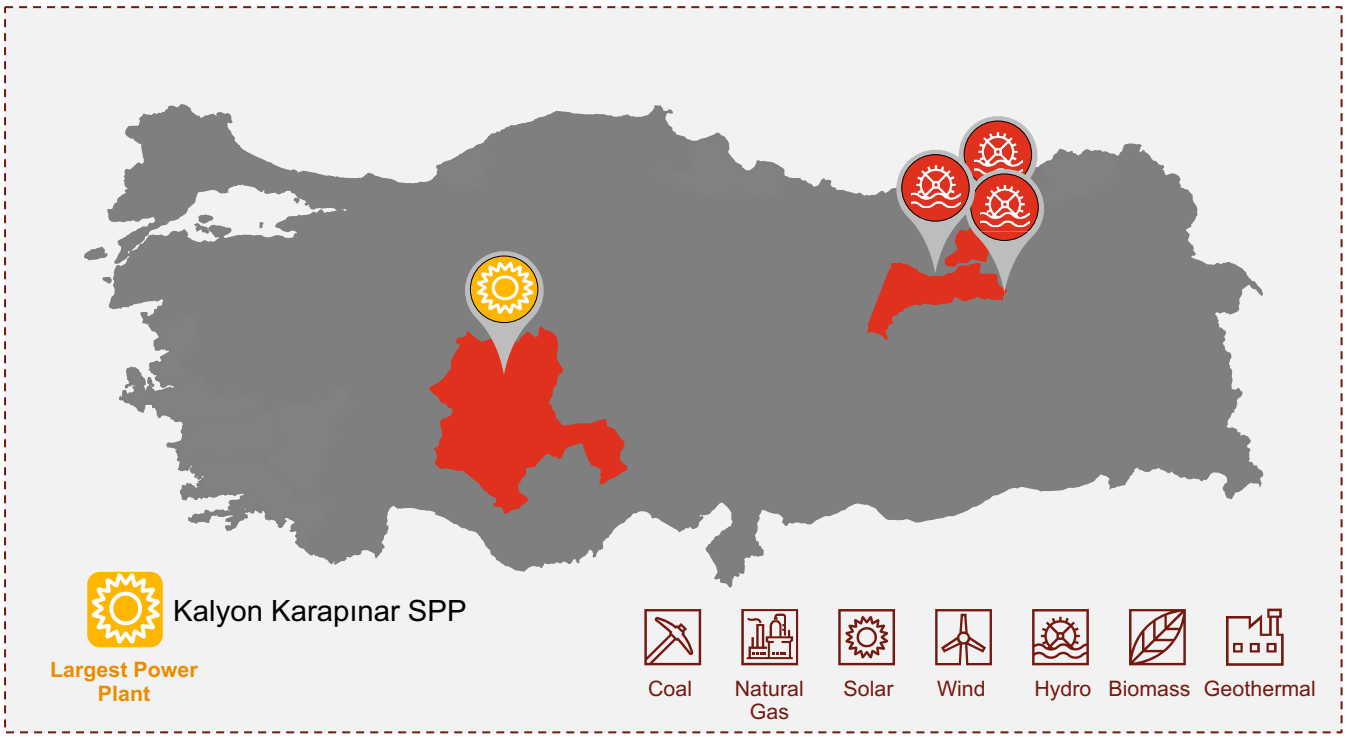
Kalyon Enerji	
Source With Highest Share	Hydropower
Status	Private Company
Number of Licensed Facilities	6
Installed Capacity (MW)	1,172
Market Share in Turkey (%)	1.1%

Graph 95

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

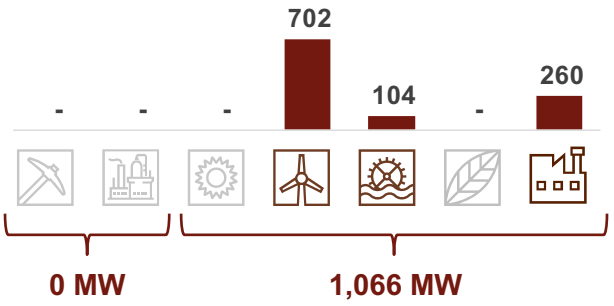


Source: Publicly Available Data (as of May 2023)

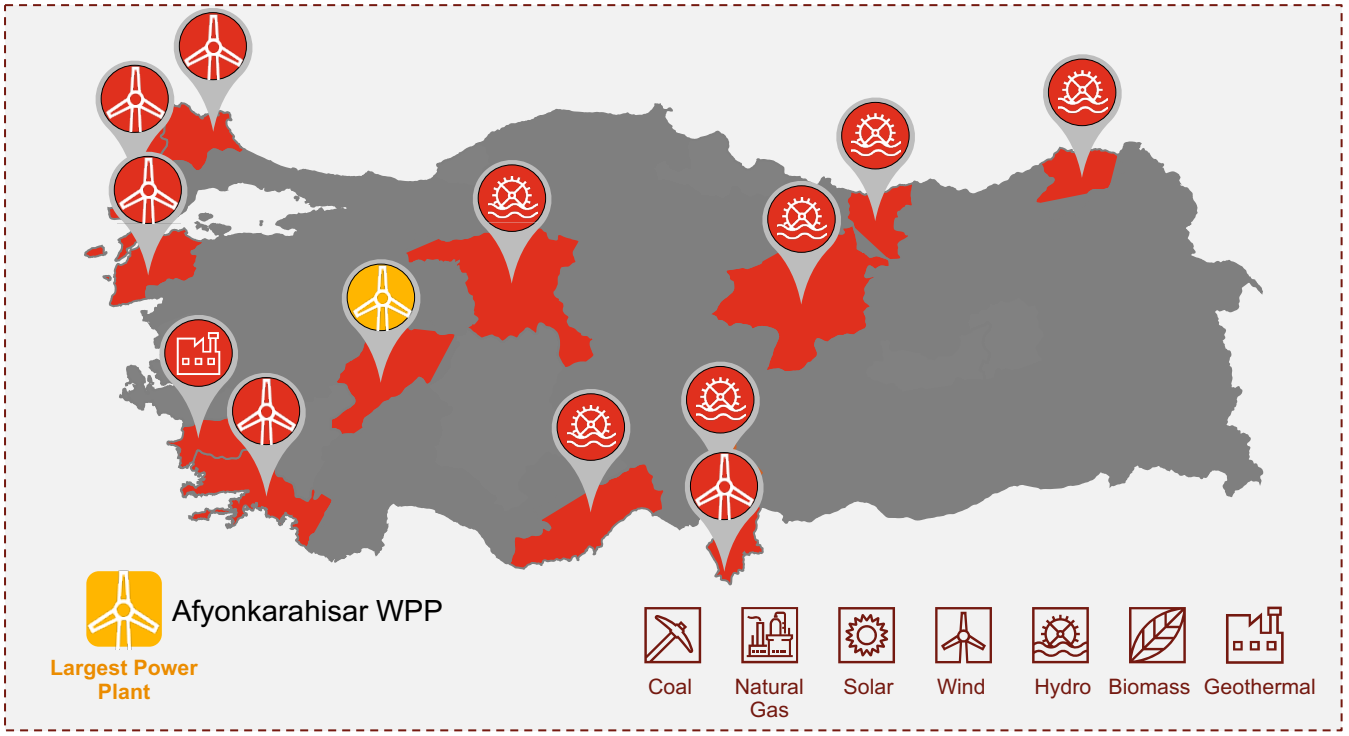
GÜRİŞ&MOGAN	
Source With Highest Share	Wind
Status	Private Company
Number of Licensed Facilities	24
Installed Capacity (MWm)	1,066
Market Share in Turkey (%)	1.0%

Graph 96

Company Installed Capacity (MW, 2023)



Activities Within Value Chain



Source: Publicly Available Data (as of May 2023)

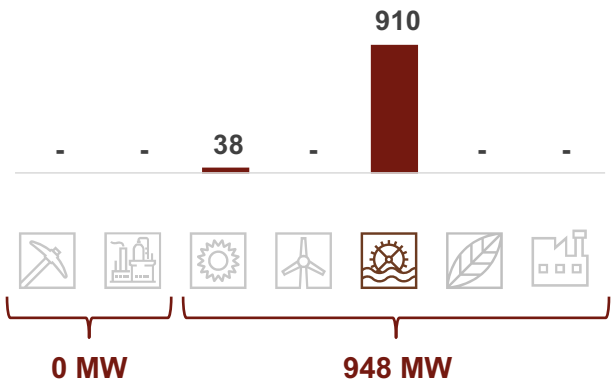
ÖZALTIN

Özaltın Enerji	
Source With Highest Share	Hydroelectric
Status	Private Company
Number of Licensed Facilities	6
Installed Capacity (MW)	948
Market Share in Turkey (%)	0.9%

Graph 97

Company Installed Capacity (MW, 2023)

Özaltın has 50% shares in Beyhan, Yukarı Kaleköy (Rest of both facilities owned by Cengiz), and Ceyhan (50% owned by Nurol).



Activities Within Value Chain

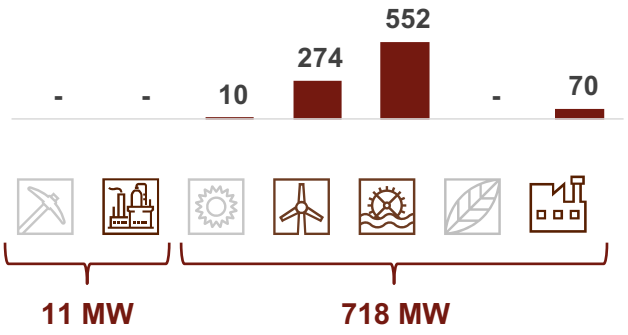
Source: Publicly Available Data (as of May 2023)

SANKO ENERJİ

Sanko Enerji	
Source With Highest Share	Hydroelectric
Status	Private Company
Number of Licensed Facilities	15
Installed Capacity (MW)	905
Market Share in Turkey (%)	0.9%

Graph 98

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

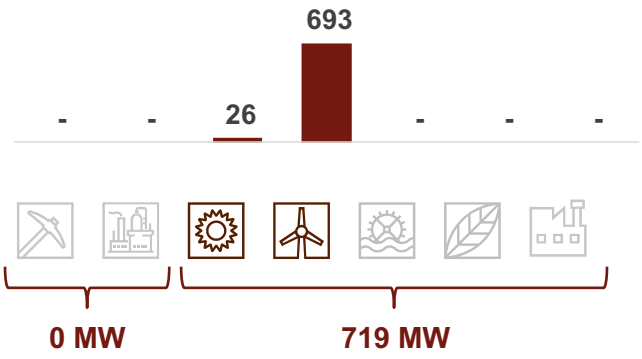
Source: Publicly Available Data (as of May 2023)

POLAT ENERJİ

Polat Enerji	
Source With Highest Share	Wind
Status	Private Company
Number of Licensed Facilities	11
Installed Capacity (MW)	719
Market Share in Turkey (%)	0.7%

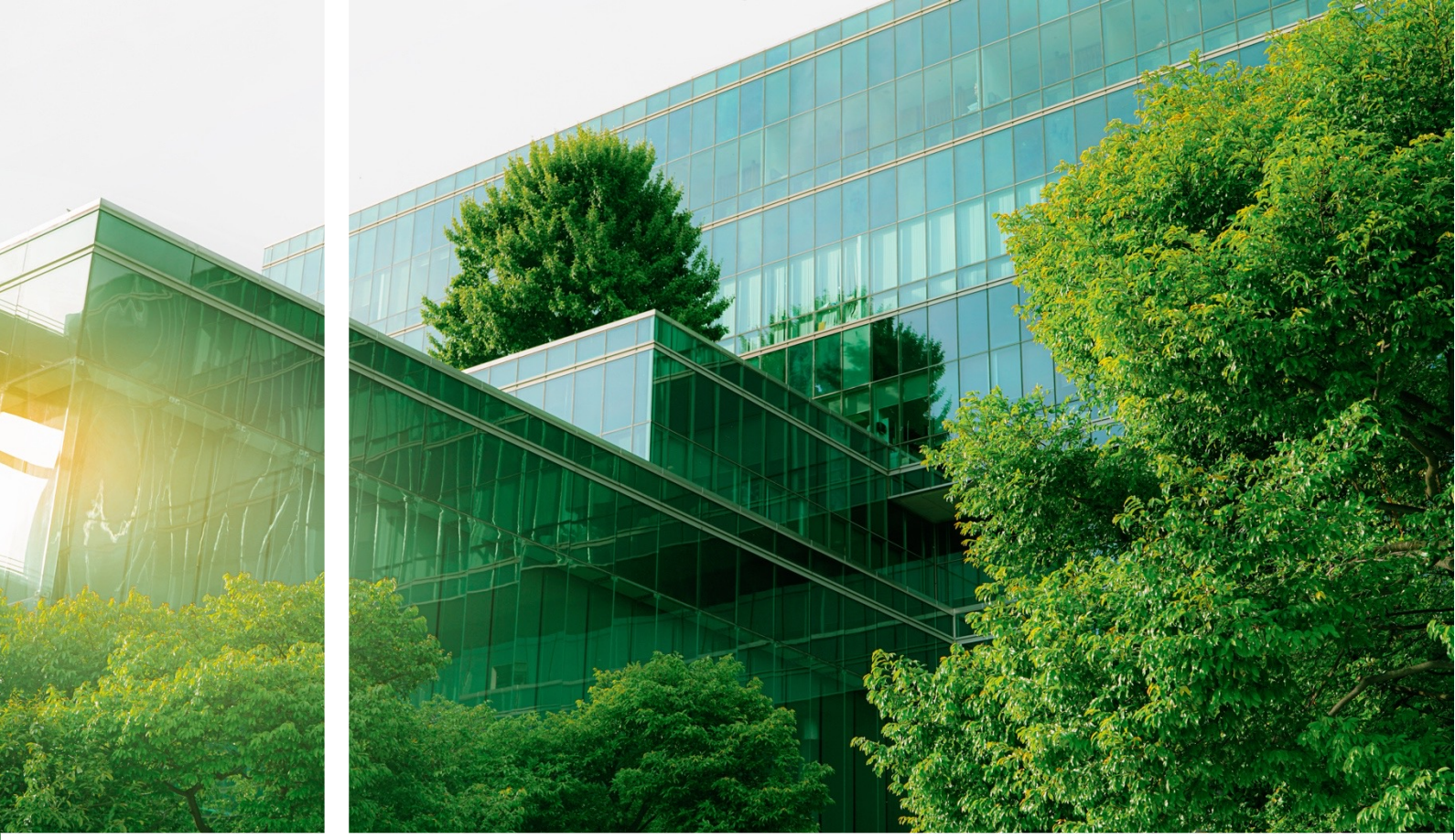
Graph 99

Company Installed Capacity (MW, 2023)



Activities Within Value Chain

Source: Publicly Available Data (as of May 2023)



10

Regulatory and Other Trends

An important step towards promoting share of renewable energy and reducing carbon emissions, The Green Certificate Market in Türkiye started in June 2021.

In operation since **June 2021**, **YEK-G system** is designed to track all phases of electricity generated from renewable sources. **EXIST** operates as the **market regulator**. Companies with renewable energy production and supply licenses could participate in the system on a voluntary basis. YEK-G certificates are generated for each 1MWh energy production and could be transferred electronically via **bilateral agreements** or through the **organized YEK-G market**. The YEK-G certificates possess international recognition and could be utilized in carbon footprint calculations.,

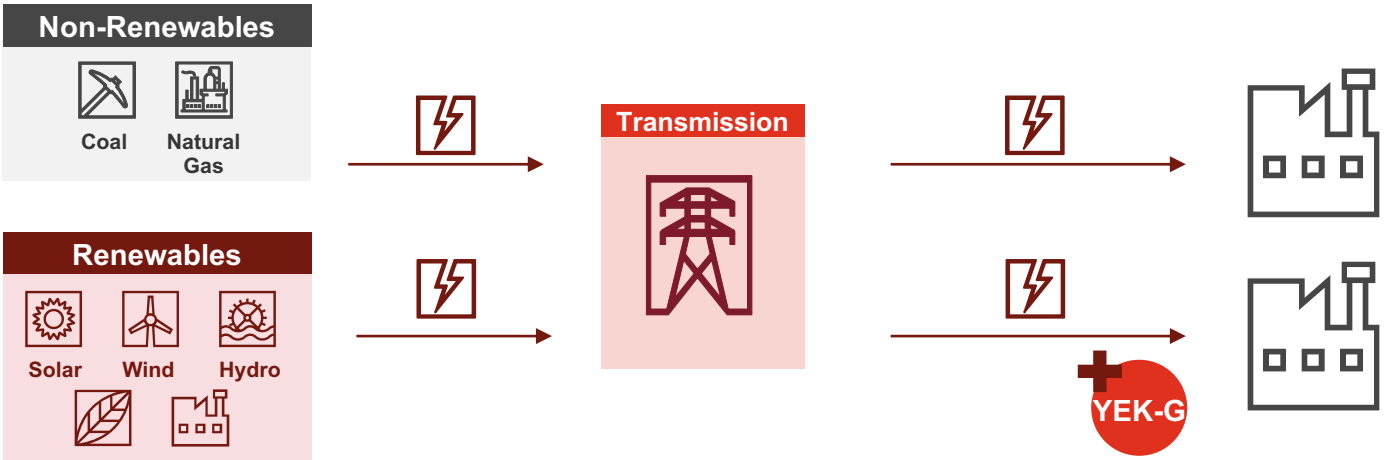
YEK-G Certificate Transfer Methods

Bilateral Agreements

The certificates could be transferred via agreements signed between two system users. The agreement must be notified to EXIST.

Organized YEK-G Market

System users could also engage in certificate transfer activities through the organized market for YEK-G certificates.



Green Certificate (YEK-G Certificate)

1. **Every 1 MWh** electricity **production** will correspond to a **YEK-G Certificate**.
2. The **YEK-G certificate** is sent to the end-user by utilizing the blockchain technology via a unique certificate code.
3. The **YEK-G certificate** includes the name of the production plant, its installed capacity, the production period of the electricity, and inform about the environmental impact.
4. The system users notify EXIST to state that the generated and certified renewable energy has been utilized. A **document of utilization** is then issued by EXIST. End users are able to demonstrate the utilisation of renewable energy via the YEK-G certificate.

If a YEK-G certificate has not been processed as utilized after 12 months of the end date of the generation period, then that certificate is deemed as **expired**.

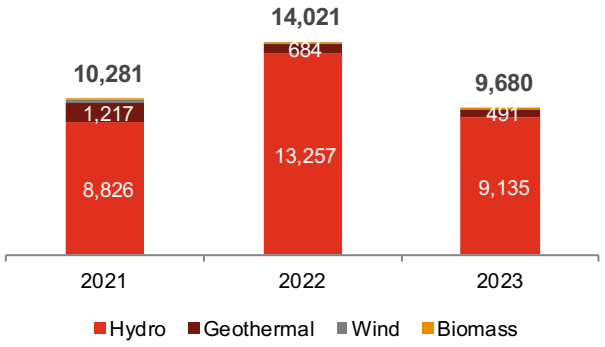
Expired certificates are **terminated** and cannot be processed for another utilization.

Source: EXIST, EMRA

Since the establishment of YEK-G system in June 2021, the total capacity of issued and utilized YEK-G certificates has surpassed 25 TWh and 5 TWh, respectively.

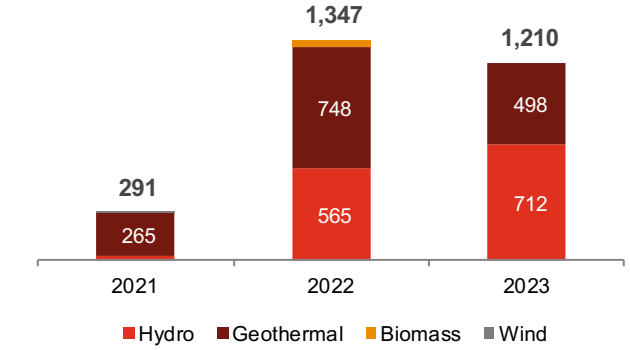
Graph 100

Total Capacity of Issued YEK-G Certificates in Organized Market (2021-2023[1], GWh)



Graph 101

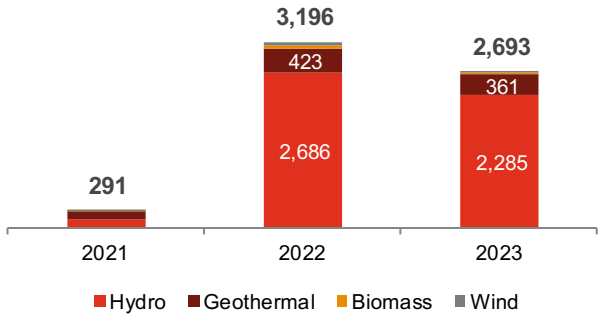
Total Capacity of YEK-G Certificates Transferred via Bilateral Arrangements (2021-2023[1], GWh)



The majority of the certificates issued in the organised YEK-G market are sourced from HPPs; however, in the case of bilateral agreements, Zorlu Enerji's initiative for utilizing the certificates from its Kızıldere-3 GPP has increased the total capacity of GPP-sourced certificates.

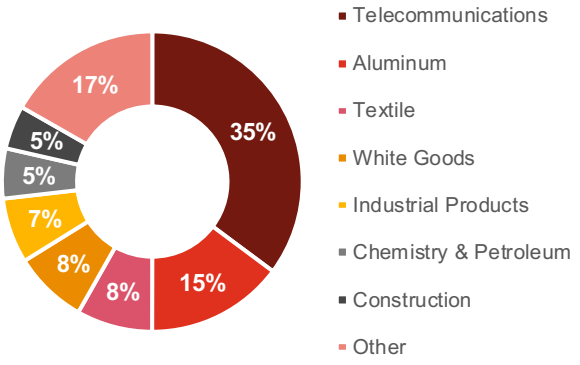
Graph 102

Total Capacity of Utilized YEK-G Certificates (2021-2023[1], GWh)



Graph 103

Share of Utilized YEK-G Certificates by Industry in 2021 (%)



Similar to the case observed in the organized market, HPP-sourced certificates constitute the majority of all utilized YEK-G certificates, with those sourced from GPPs occupy the second place. When the industry breakdown is observed, it is seen that half of the all utilized certificates are used in telecommunications and aluminum industries.

[1]2023 data consist of the last 12 months covering July 2022 to June 2023.

Source: EXIST

The green tariff (YETA) enacted by EMRA on 1 August 2020 will ensure that renewable energy is indirectly supported by the private sector.

Renewable energy installed capacity, which contributed 54% of the total installed capacity as of May 2023, will be promoted with the introduction of this policy. Consumers who want to use energy within the scope of YETA will be able to buy electricity based on renewable sources from their supplier companies.

YETA users will only buy electricity generated from renewable energy resources. YETA is only available for electricity generated by licensed renewable power plants. Consumers can also request a green energy certificate from their suppliers. The renewable energy source guarantee certificate (YEK-G certificate) will be provided to consumers to prove that the energy used by them is generated from these sources. Thus, companies will be able to prove the source of the electricity they provide to their consumers by creating a YEK-G certificate for each megawatt-hour of electricity they generate.

The introduction of the YEK-G regulation on June 2021 has marked the complete beginning of the YEKA period.

Consumers will be able to switch to YETA by applying to the company from which they receive energy. The request to switch to YETA can only be made twice in each calendar year. EMRA will issue a certificate for consumers who are using YETA, enabling them to prove their tariffs.

Table 30

Energy Costs Based on Tariffs,
(July 2023, kr/kWh)

	Active Energy Cost	Active Energy Cost of Green Tariff
Industrial	243.7926	258.4316
Commercial	221.7619	258.4316
Household	48.2187	258.4316

Even though the tariffs are more expensive, consumers may prefer YETA to protect the environment by using renewable energy with zero-emissions. The MENR argues that YETA can be considered a social responsibility project where consumers support the use of renewable energy by using the green tariff. Furthermore, using YETA may benefit the reputations of firms, which will be a significant factor for both domestic and foreign markets. The MENR is planning on channelling these motivations into the development of renewable energy in Türkiye.

Source: EMRA

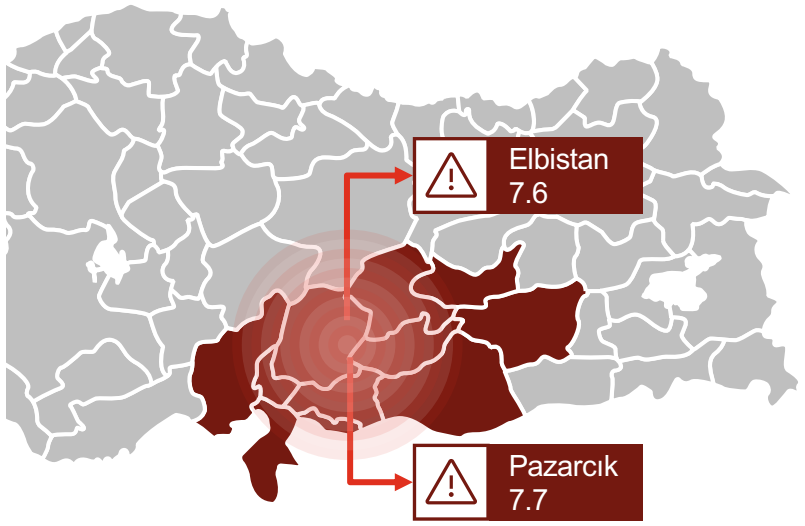
According to the Presidency of Türkiye, the total damage caused by the Kahramanmaraş Earthquakes in the energy sector is estimated to be around 11.2 billion TL. 21% of the damage occurred is in public sector assets, whereas 79% of the damage is sustained by the private sector.

Table 31

Provinces Affected by Kahramanmaraş Earthquakes and Assessed Damage (m TL)

On 6 February 2023, Türkiye was hit with two large-scale earthquakes with epicenters in Pazarcık and Elbistan districts of Kahramanmaraş, causing unprecedented damage.

The Kahramanmaraş earthquakes claimed the lives of approximately **48,000** people, and damaged **over 500,000** buildings. The total damage caused by the Kahramanmaraş earthquakes is estimated to be **2 trillion TL**.



Province	Public Sector						Private Sector					Grand Total
	Electricity Transmission	Power Generation	Natural Gas Transmission	Oil Transmission and Storage	Other	Total	Electricity Distribution	Natural Gas Distribution	Power Generation	Liquid Oil facilities	Total	
Kahramanmaraş	407.0	512.0	83.0	-	-	**1,002.0**	151.2	37.1	52.0	88.7	**329.0**	**1,331.0**
Hatay	220.4	-	12.5	0.5	-	**233.4**	4,342.1	104.4	-	113.3	**4,559.8**	**4,793.2**
Gaziantep	48.4	-	-	1.0	-	**49.4**	1,965.0	-	-	24.6	**1,989.6**	**2,039.0**
Şanlıurfa	17.4	0.1	-	-	-	**17.5**	70.3	4.0	-	5.7	**80.0**	**97.5**
Adıyaman	13.1	-	55.0	-	-	**68.1**	59.8	292.1	-	45.0	**396.9**	**465.0**
Malatya	-	-	30.0	-	-	**30.0**	297.0	177.5	-	67.0	**541.5**	**571.5**
Osmaniye	6.4	0.3	-	-	-	**6.7**	505.6	15.8	0.5	8.6	**530.5**	**537.2**
Diyarbakır	-	5.1	-	-	-	**5.1**	130.8	0.2	-	1.0	**132.0**	**137.1**
Kilis	-	-	-	-	-	**0.0**	159.6	-	-	-	**159.6**	**159.6**
Adana	4.3	-	-	10.7	-	**15.0**	162.8	10.5	-	1.1	**174.4**	**189.4**
Elazığ	-	-	-	-	-	**0.0**	23.0	4.8	-	-	**27.8**	**27.8**
Total	**717.0**	**517.5**	**180.5**	**12.2**	**895.2**	**2,322.4**	**7,867.2**	**646.4**	**52.5**	**355.0**	**8,921.1**	**11,243.5**

Throughout the reconstruction process of the energy infrastructure in region, it is expected that more disaster-resilient and efficiency-driven systems will be incorporated as a result of Türkiye's climate change agenda. Investments such as microgrid structures, off-grid and mobile electricity generation units, electricity storage facilities, FSRU vessels and natural gas storage facilities can be considered as steps towards these goals. Given that these technologies cost relatively more compared to conventional nonresilient and lower efficiency systems, total reconstruction cost is expected to exceed the amount of damage sustained.

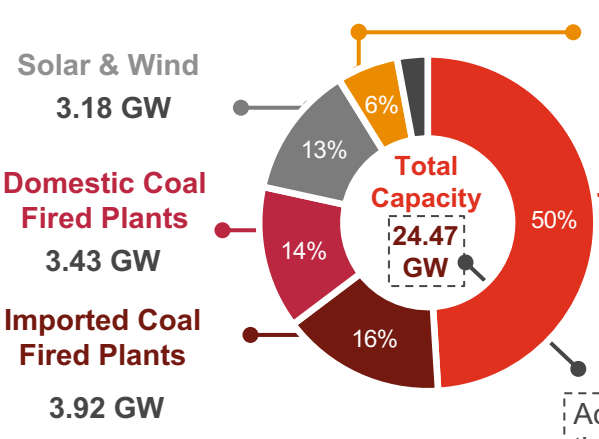
[1]Damage reported as Other in the public sector represents the damage sustained by State Hydraulic Works and cannot be allocated to the corresponding provinces.

Source: Presidency of Republic of Türkiye Department of Strategy and Budget

While reconstructing and reinforcing the energy infrastructure in the 11 earthquake-affected regions, The Presidency of Türkiye underlined the importance of executing an infrastructure approach which is resilient to all kinds of disaster risk.

Table 32

Installed Capacity in 11 Affected Regions Before the Earthquake



Accounts for 23.6% of the total installed capacity in Türkiye as of the end of 2022.

- As of the end of 2022, a total of **68.5 TWh** of electricity **generated** and **58.1 TWh** of electricity **consumed** in those regions which accounted for **21%** and **19%** of the national statistics, respectively.
- Regions affected by the earthquake used to be a important central for industrial production activities, meaning large facilities demanding significant energy demand

Total Installed Capacity in 4 Regions Most Affected by the Earthquake[1]

Kahramanmaraş	Hatay	Gaziantep	Adıyaman
4.22 GW	2.63 GW	0.44 GW	0.26 GW

Policy Recommendations

- **Damage assessment of energy infrastructure**
- **Promotion of grid-level storage and independent micro-grid systems**
- **Inspection and reinforcement of current standing infrastructure**
- **Shortening and reinforcement of the natural gas supply lines**
- **Sustainability and resilince-based reconstruction process**
- **Focus on FSRU vessels and NG underground storage facilities**

[1]Most affected 4 regions are identified by the total number of damaged buildings.

Source: Presidency of Republic of Türkiye Department of Strategy and Budget, EMRA

First announced in March 2022 as a temporary tool to curb the surge in DAMP, resource based ceiling price mechanism was implemented by EMRA.

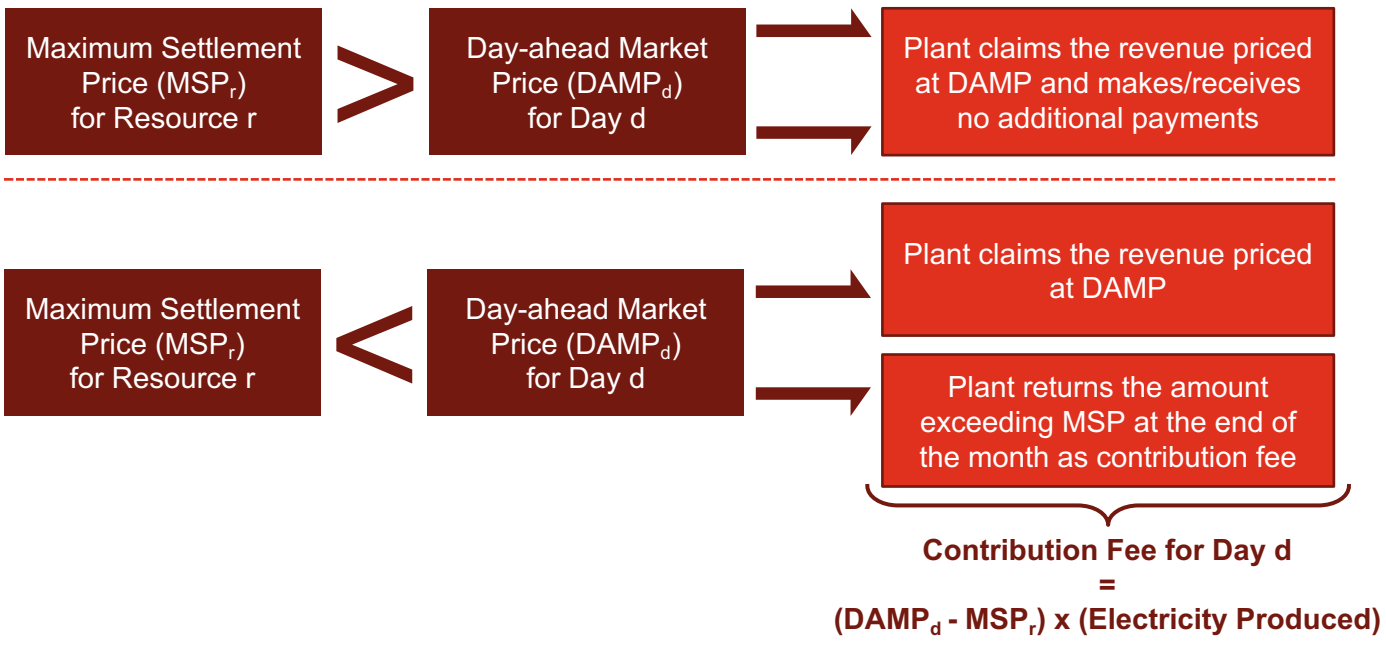
Similar to the windfall tax implemented by a number of European countries in previous years, EMRA has introduced a novel price reconciliation mechanism for the independent power producers in March 2022. The mechanism aims to support the producers that are subjected to raw material costs for energy generation and electricity distribution companies facing low end-user prices.

If a market participant sells the produced electricity on the spot markets above the price caps, the IPP is asked to pay back the amount exceeding the corresponding limits as a contribution fee for the day-ahead market. **The initial duration of the mechanism was announced to be 6 months and expected deadline was September, 2022; however, the mechanism's duration was extended twice, in September 2022 and April 2023.**

Power plants that are exempt from the resource based ceiling mechanism are as follows:

1. Currently under YEKDEM FiT scheme,
2. Acquired its license through YEKA tenders,
3. Owned by EÜAŞ or selling the produced electricity to EÜAŞ directly or indirectly,
4. Have fixed price bilateral PPAs.[1]

Settlement Procedure of the Resource Based Ceiling Price Mechanism



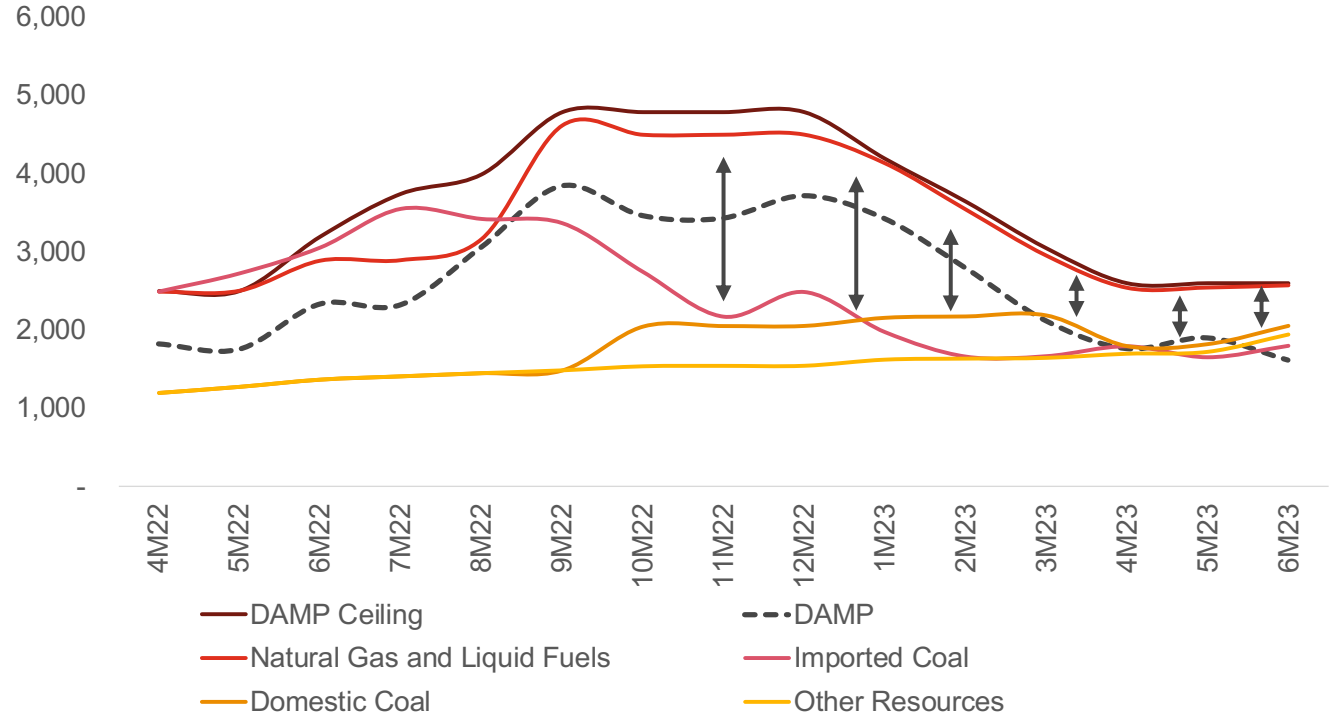
[1]Plants with fixed price bilateral PPAs have been included in the mechanism after the first extension made in September 2022.
Source: EPİAŞ

Maximum Settlement Prices of different resources vary based on the acquisition costs related to the source used in the electricity production process.

Since the introduction of the mechanism in April 2022, plants using the renewable energy sources have been subjected to the lowest price caps due to no fuel being involved in the electricity generation process. Plants utilizing imported fuel types such as natural gas and imported coal were subjected to higher prices; however, after later 2022, MSP for imported coal plants were gradually lowered by EMRA.

Graph 104

Day-ahead Market Price Ceiling and Maximum Settlement Prices for Various Plant Types, (4M22-6M23, TL/MWh)



Especially in the last quarter of 2022, MSP determined for NG plants increased substantially, following the sharp hikes implemented on BOTAŞ tariffs for power plants. After reaching its peak in August 2022, MSP for NG plants sustained its relatively high level compared to other resources and followed the DAMP ceiling closely. As the BOTAŞ tariffs for power plants were lowered gradually in 2023, both MSP for NG plants and DAMP ceiling have started to converge to the MSP implemented on other resources.

Factors Affecting MSP

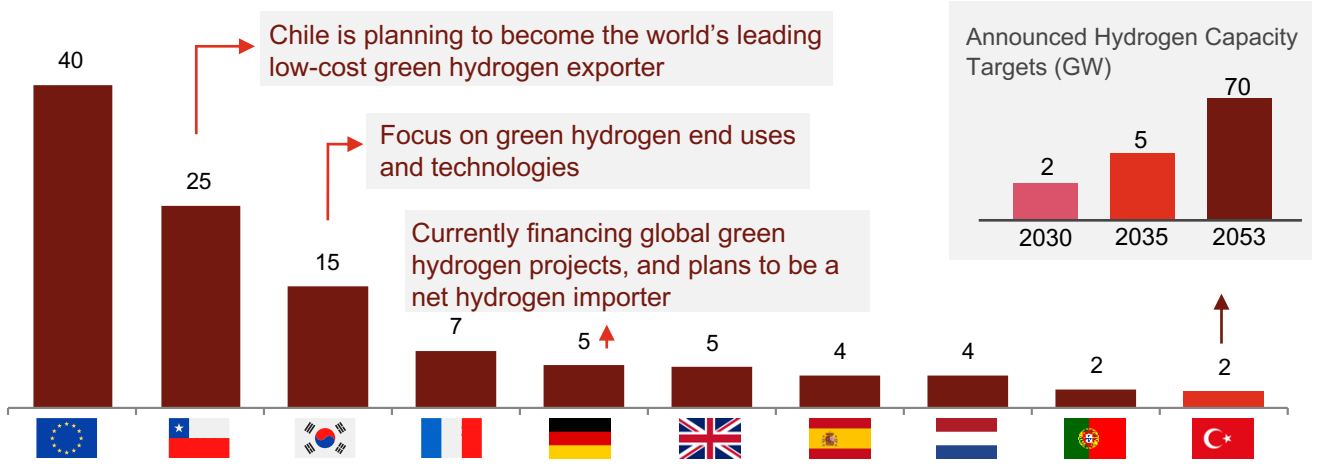
1. Consumer Price Index
2. ICE Rotterdam Coal Futures
3. BOTAŞ Tariff for Power Plants
4. CBRT Effective USD Selling Rate
5. Transmission System Usage Fee

Source: EPİAŞ

Europe's expansionist approach on hydrogen production investments and Germany's eagerness to finance hydrogen projects can cause Türkiye to be positioned as a net green hydrogen supplier for the major EU countries.

Graph 105

Installed Capacity Targets for Green Hydrogen for 2030 (GW)



The EU aims to install 17.5 GW electrolyzer capacity by 2025. Germany has already commissioned 120 pilot investments for green hydrogen production with several import projects (Türkiye and Chile being important potential suppliers).

- With Türkiye's abundant renewable energy sources, and Germany's leading green hydrogen technology, a collaboration between countries can expand the hydrogen market both in Türkiye and EU.

Table 33

Priorities mentioned in Türkiye's Hydrogen Technologies and Strategy Roadmap

Installed Capacity Targets Installed **capacity** of **hydrogen electrolyzers** is estimated to be **2 GW** by **2030**, **5 GW** by **2035**, and **70 GW** in **2053**	**R&D Support Mechanism** R&D support mechanisms on the **utilization** of **domestic sources** in hydrogen **production** and **storage**
Production Costs The **production cost** of hydrogen is expected to be **2.4 USD/kgH** by **2035** and decrease to **1.2 USD/kgH** by **2053**	**Public-Private Sector Relation** Prioritization of **public** and **private** sector **collaboration** to increase efficiency and commercial demand
Prioritized End-User Industries Implementation of **incentive mechanisms** in order to **expand** the **usage of hydrogen** in **carbon-dominant** sectors	**Green Hydrogen and Ammonia** Focusing on **export** of **green hydrogen** and **ammonia** to the trade partners of **Türkiye**

Source: MENR

With the National Hydrogen Technologies Strategy and Roadmap, investments and focus on green hydrogen in Türkiye is expected to accelerate.

1 Hydrogen Technology R&D Project

SOCAR Türkiye R&D and Innovation Center, in collaboration with **Sabanci** University, announced its focus on **Hydrogen** (H2) **based Technologies**.

- Project **aims** to **develop** original **electrodes** containing **advanced catalysts** for the production of **green hydrogen from water**.

2 TÜPRAŞ Green Hydrogen Project

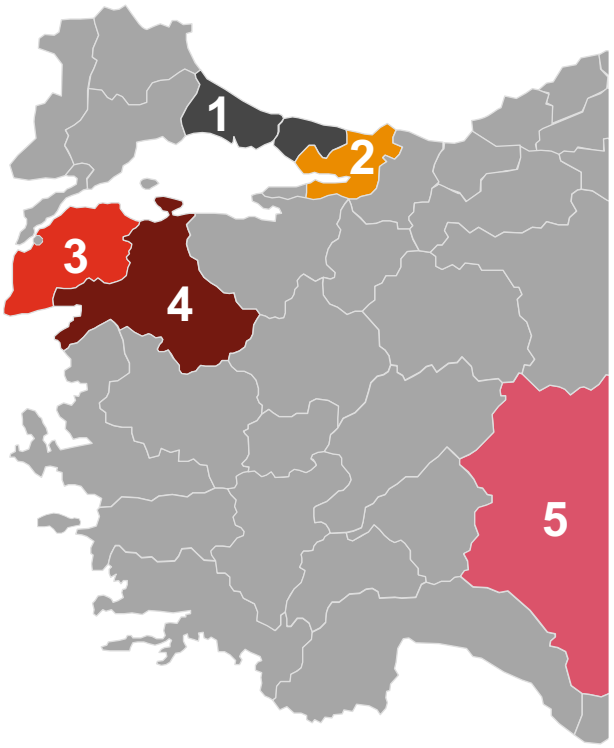
TÜPRAŞ plans to **generate green hydrogen** in solar power plants located in **Kırıkkale** and **Batman** in 2025.

- The generated green hydrogen is **planned** to be **sold** to **logistics** and **transportation** sector.

3 Bozaacada Hydrogen Project

Bozcaada **Hydrogen pilot production plant** was established in Bozcaada in **2011**.

- The Project was established with the **support** and incentives of **Ministry of Energy**, in order to provide electricity to **local residential areas**. The Project has been **terminated**.



4 HYSouthMarmara Project

In accordance with the protocol signed on February 15, 2022, **Enerjisa's Bandırma** Plant initiated its **R&D** activities.

This green hydrogen driven facility will mark a significant milestone as it becomes the **first facility** in the Turkish industry **to engage** in the **production** and **utilization** of **green hydrogen**.

Listed **firms** participating in the Project:

- **ETİ Maden**
- **TUBITAK MAM**
- **Aspilsan Energy**

5 GAZBİR Hydrogen Project

The **Hyvillage** project, Hydrogen **R&D laboratory**, was set up in 2021.

Studeies stated that **up to 20%** of hydrogen can be mixed into the lines

- The **aim** of the HyVillage project is to **blend hydrogen** into **natural gas** in certain proportions and **supply** the **mixture gas** to residential buildings, process **testing laboratories**, and **central heating system** testing laboratories.

Source: MENR

Since the beginning of 2021, multiple energy companies focusing on renewable energy have floated their shares on İstanbul Stock Exchange. These companies operate on various sections of the Turkish electricity market value chain.

hun enerji

- **IPO Date:** 21 February 2022
- **IPO EV:** 201m USD[1]
- **IPO M.Cap:** 85m USD
- **Recent EV: 3**13m USD[1]

Hun Enerji is **electricity generation** company with a portfolio of renewable energy sources such as **solar (unlicensed), Hydro, and biomass with capacities of 66.2 MWp**, **26.1 MWp**, and **10.5 MWp** respectively.

(m USD)	2021	2022	2023[2]
Revenue	12	28	26
EBITDA	6	13	11
EBITDA Margin	44%	45%	42%

Aydem yenilenebilir enerji

- **IPO Date:** 29 April 2021
- **IPO EV:** 1,4bn USD[1]
- **IPO M.Cap:** 788m USD
- **Recent EV:** 1bn USD[1]

Aydem Yenilenebilir Enerji is a renewable energy generation company with a portfolio consisting of **hydro** (**852 MW**), **wind** (**214.5 MW**), **geothermal** (**6.9 MW**), and **hybrid** (**82.2 MW**) power plants.

(m USD)	2021	2022	2023[2]
Revenue	94	230	216
EBITDA	67	187	155
EBITDA Margin	71%	81%	72%

Smart GÜNEŞ TEKNOLOJİLERİ

- **IPO Date:** 24 March 2022
- **IPO EV:** 171m USD[1]
- **IPO M.Cap: 159**m USD
- **Recent EV: 1.7bn** USD[1]

Smart Güneş Teknolojileri is an **integrated solar energy company** that **produces photovoltaic solar panels** in Ankara Türkiye, the plant capacity amounting **1.7 GW**. In 2023, **Smart** announced its **solar cell production power plant** (**capacity of 2 GW**) investment in İzmir.

(m USD)	2021	2022	2023[2]
Revenue	64	118	137
EBITDA	9	15	18
EBİTDA Margin	13%	13%	13%

kartal enerji

- **IPO Date:** 16 July 2021
- **IPO EV:** 85m USD[1]
- **IPO M.Cap:** 57m USD
- **Recent EV: 79**m USD[1]

Kartal Enerji ia an unlicensed electricity **generation** company with **solar** power plants (capacity of **54 MWp**).

(bn USD)	2021	2022	2023[2]
Revenue	7	11	11
EBITDA	4	8	7
EBITDA Margin	60%	76%	65%

GALATAWIND

- **IPO Date:** 22 April 2021
- **IPO EV:** 432m USD[1]
- **IPO M.Cap:** 358m USD
- **Recent EV: 448**m USD[1]

Galatawind is an **electricity generation** company with a portfolio consisting of **solar** and **wind** power plants, with a total **capacity** of **269 MW**. Currently, the installed capacity of **SPP's** is **34.1 MW** and **WPP's** is **230.4 MW**.

(m USD)	2021	2022	2023[2]
Revenue	40	72	66
EBITDA	32	61	53
EBITDA Margin	80%	85%	80%

MARGÜN

- **IPO Date:** 30 September 2021
- **IPO EV:** 389m USD[1]
- **IPO M.Cap: 384**m USD
- **Recent EV: 95**8m USD[1]

Margün Energy is an **electricity generation and EPC company (operates both in Türkiye and overseas).** The company has a total of **118 MWp capacity** of **solar** power plants. Recently, Margün has acquired %30 shares of Enda Enerji for 1.1 bn TL.

(m USD)	2021	2022	2023[2]
Revenue	39	40	33
EBITDA	18	21	18
EBITDA Margin	47%	53%	53%

[1]Enterprise Value (EV)=Market Capitalization (M.cap)+Total Debt–Cash&Cash Equivalents
[2]LTM as of 30.06.2023

Source: PwC Analysis, Company Websites

Companies operate on various sections of the Turkish electricity market value chain including electricity generation, EPC services and equipment manufacturers.

BIOTREND

- **IPO Date:** 28 April 2021
- **IPO EV:** 375m USD[1]
- **IPO M.Cap:** 317m USD
- **Recent EV: 467**m USD[1]

Biotrend Energy engages in **power generation** and **integrated solid waste management** activities in Türkiye. The total installed capacity is 97.8 Mwe consisting of 83.14 MWe from **biogas** and 14.6 MWe from **biomass**.

(m USD)	2021	2022	2023[2]
Revenue	32	74	76
EBITDA	9	27	22
EBITDA Margin	28%	36%	29%

akfen YENİLENEBİLİR ENERJİ

- **IPO Date:** 16 March 2023
- **IPO EV:** 935m USD[1]
- **IPO M.Cap: 577**m USD
- **Recent EV: 990**m USD[1]

Akfen Yenilenebilir Enerji is a **electricity generation** company with a portfolio of **Hydro**, **solar**, and **wind** power plants (total **capacity** of **699 MW**).

(m USD)	2021	2022	2023[2]
Revenue	98	150	135
EBITDA	73	115	99
EBITDA Margin	75%	77%	73%

CW Enerji

- **IPO Date:** 5 May 2023
- **IPO EV:** 754m USD[1]
- **IPO M.Cap:** 758m USD
- **Recent EV:** 1.5bn USD[1]

CW Enerji is a **PV manufacturer**, and a **EPC** company. The company's PV glass **production plant** has a total **capacity** of **1.8 GW**. CW Enerji plans to build a cell manufacturing plant with a capacity of 1 GW.

(m USD)	2021	2022	2023[2]
Revenue	76	287	390
EBITDA	11	60	71
EBITDA Margin	14%	21%	18%

ALFA SOLAR ENERJİ

- **IPO Date:** 16 October 2022
- **IPO EV:** 151m USD[1]
- **IPO M.Cap:** 159m USD
- **Recent EV: 1.3bn** USD[1]

Alfa Solar Enerji is a **photovoltaic** (PV) **panel manufacturing and EPC company**. As of June 2023, the PV panel **production plant** has a total **capacity** of **1.3 GW** and a **production 3 million solar panels per year.**

(m USD)	2021	2022	2023[2]
Revenue	33	123	164
EBITDA	6	26	35
EBITDA Margin	18%	21%	21%

Ahlatcı doğalgaz

- **IPO Date:** 22 December 2022
- **IPO EV: 859**m USD[1]
- **IPO M.Cap: 809**m USD
- **Recent EV: 1.1bn** USD[1]

Ahlatçı Doğal Gaz Dağıtım engages in natural gas distribution activities in Türkiye. Ahlatçı is one of the biggest Natural Gas distribution company in Türkiye, in 10 cities serving more than 1.5 million subscribers.

(m USD)	2021	2022	2023[2]
Revenue	280	647	605
EBITDA	34	44	44
EBITDA Margin	12%	7%	7%

NATURELGAZ

- **IPO Date:** 1 April 2021
- **IPO EV:** 129m USD[1]
- **IPO M.Cap:** 132m USD
- **Recent EV: 271**m USD[1]

Naturelgaz is **natural gas transportation company**, supplying **CNG** and **LNG** products. Naturelgaz **owns 12 bulk CNG filling stations**, and **7 Auto CNG stations**. In October 2020, **Naturelgaz acquired Socar Türkiye's LNG** and **CNG operations** for **32 million TL**.

(m USD)	2021	2022	2023[2]
Revenue	53	201	153
EBITDA	6	45	31
EBITDA Margin	11%	22%	20%

[1]Enterprise Value (EV)=Market Capitalization (M.cap)+Total Debt–Cash&Cash Equivalents
[2]LTM as of 30.06.2023

Source: PwC Analysis, Company Websites

As of June 2023, there are 10 energy companies that floated their shares of İstanbul Stock Exchange before 2021 and 15 that made their IPO's after 2021. As of June 2023, the total market capitalization of the energy companies amounted to USD 12.2bn.

DOĞU ARAS ENERJİ YATIRIMLARI A.Ş.

- **IPO Date:** 11 November 2021
- **IPO EV:** 747m USD [1]
- **IPO M.Cap:** 747m USD
- **Recent EV: 546**m USD [1]

Doğu Aras Enerji Yatırımları is a **energy retail** and **distribution** company based in Erzurum, Türkiye. Doğu Aras operates in **7 cities** and in **58 counties** with nearly **1.5 million subscribers**.

(m USD)	2021	2022	2023[2]
Revenue	464	838	626
EBITDA	41	74	59
EBITDA Margin	9%	9%	9%

ÇAN2 TERMİK

- **IPO Date:** 30 April 2021
- **IPO EV:** 363m USD [1]
- **IPO M.Cap:** 166m USD
- **Recent EV: 665m** USD [1]

Çan2 Termik is an **electricity generation** company with a **coal fired thermal** power plant and also engages in **mining** of antimony and precious metals. The **thermal power plant** has an **installed capacity** of **330MW**.

(m USD)	2021	2022	2023[2]
Revenue	90	311	229
EBITDA	27	118	67
EBITDA Margin	30%	38%	29%

CONSUS

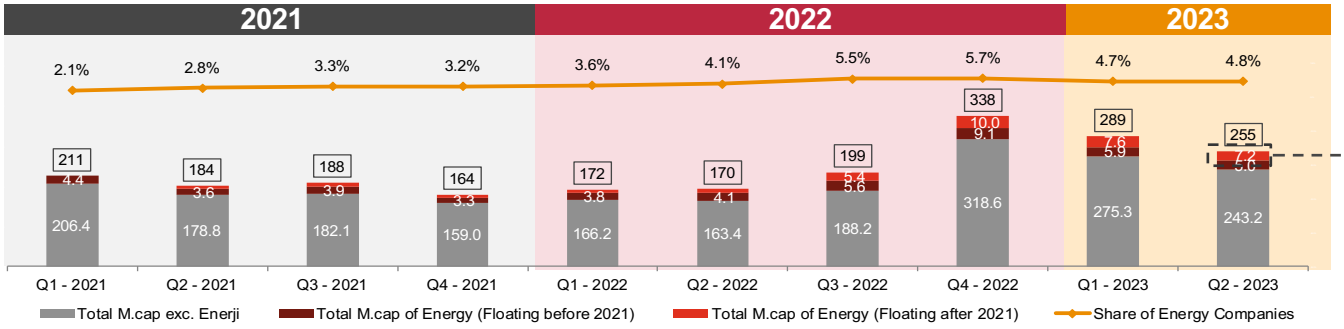
- **IPO Date:** 20 April 2023
- **IPO M.Cap:** 120m USD
- **IPO EV:** 164m USD [1]
- **Recent EV:** 165m USD [1]

Consus Enerji is an **electricity generation** and a **EPC company**, focusing on biomass, solar, and distributed power plants. The company's **biomass, solar**, and **distributed** power plants has a total **installed capacity** of **29.2 MW**, **10.8 MW**, and **54.1 MW**, respectively.

(m USD)	2021	2022	2023[2]
Revenue	28	34	36
EBITDA	11	11	9
EBITDA Margin	38%	31%	24%

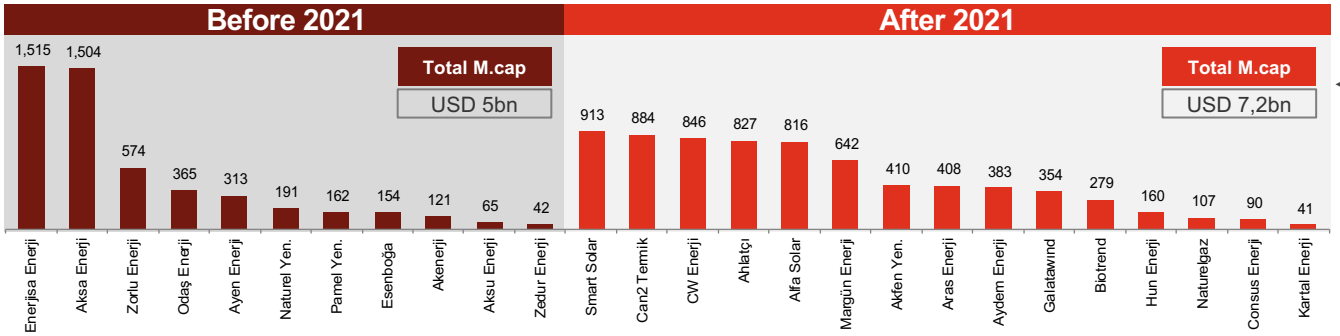
Graph 106

Total M.cap of Energy Companies and All of the Publicly Traded Companies (USD bn)



Graph 107

Market Capitalization of Energy Companies, Floated after and before 2021 (Q2-2023)



[1]Enterprise Value (EV)=Market Capitalization (M.cap)+Total Debt–Cash&Cash Equivalents [2]LTM as of 30.06.2023

Source: PwC Analysis, Company Websites

Key financial and operational information on publicly traded renewable energy focused companies can be found in the table below.

Table 34

Equipment Manufacturer | Electricity Generation | EPC

	Companies (m USD)	2022		2023[1]		Services
		Revenue	EBITDA	Revenue	EBITDA	
1	Zorlu Enerji Elektrik Üretim A.Ş.	1,816.6	372.5	1,790.9	361.0	
2	Akenerji Elektrik Üretim A.Ş.	1,029.9	114.1	1,159.0	112.4	
3	Ayen Enerji A.Ş.	410.3	140.0	371.7	98.2	
4	CW Enerji Mühendislik Tic. Ve San. A.Ş.	287.5	59.9	389.9	70.6	
5	Aydem Yenilenebilir Enerji A.Ş.	230.1	186.6	216.2	154.7	
6	Akfen Yenilenebilir Enerji A.Ş.	150.4	115.3	135.5	99.3	
7	Biotrend Çevre ve Enerji Yatırımları A.Ş.	74.4	26.9	75.8	22.1	
8	Galata Wind Enerji A.Ş.	71.7	60.9	66.2	53.3	
9	Natural Yenilenebeilir Enerji Ticaret A.Ş.	59.2	24.8	59.8	15.9	
10	Esenboğa Elektrik Üretim A.Ş.	58.3	23.6	50.1	15.0	
11	Margün Enerji Üretim San. Ve Tic. A.Ş.	39.5	20.9	33.3	17.8	
12	Consus Enerji İşletmeciliği ve Hiz. A.Ş.	33.8	10.6	35.5	8.6	
13	Hun Yenilenebilir Enerji Üretim A.Ş.	27.8	12.6	25.6	10.6	
14	Kartal Yenilenebilir Enerji Üretim A.Ş.	10.8	8.3	10.5	6.8	
15	Zedur Enerji Elektrik Üretim A.Ş.	4.5	2.3	3.8	2.0	
16	Aksu Enerji ve Ticaret A.Ş.	2.0	1.4	1.8	1.2	
17	Pamel Yenilenebiir Elektrik Üretim A.Ş.	1.6		1.2		

	Companies	Total Capacity	Sources - Renewable					Other	
			SPP	WPP	HPP	BPP	GPP	NG	CCGT
1	Zorlu Enerji Elektrik Üretim A.Ş.	**642,8**		135,0	118,9		305,0	83,8	
2	Akenerji Elektrik Üretim A.Ş.	**1.224,0**		24,5	293,8			905,8	
3	Ayen Enerji A.Ş.	**410,0**		106,3	303,7				
4	CW Enerji Mühendislik Tic. Ve San. A.Ş	**10,6**	10,6						
5	Aydem Yenilenebilir Enerji A.Ş.	**1.155,7**	82,2	214,5	852,1		6,9		
6	Akfen Yenilenebilir Enerji A.Ş.	**698,4**	120,9	348,8	228,6				
7	Biotrend Çevre ve Enerji Yatırımları A.Ş.	**117,0**				117,0			
8	Galata Wind Enerji A.Ş.	**268,8**	234,9	33,9					
9	Natural Yenilenebeilir Enerji Ticaret A.Ş.	**100,5**	100,5						
10	Esenboğa Elektrik Üretim A.Ş.								
11	Margün Enerji Üretim San. Ve Tic. A.Ş.								
12	Consus Enerji İşletmeciliği ve Hiz. A.Ş.	**104,3**	9,8	11,4	31,6	2,4	1,9	25,4	21,8
13	Hun Yenilenebilir Enerji Üretim A.Ş.	**103,2**	66,6		26,1	10,5			
14	Kartal Yenilenebilir Enerji Üretim A.Ş.	**53,4**	53,4						
15	Zedur Enerji Elektrik Üretim A.Ş.	**16,2**	12,2		4,0				
16	Aksu Enerji ve Ticaret A.Ş.	**49,8**	7,5		42,3				
17	Pamel Yenilenebiir Elektrik Üretim A.Ş.	**18,5**	4,0		14,4				
	Total	**4.973,0**	**702,7**	**874,4**	**######**	**129,9**	**313,8**	**######**	**21,8**
	Total - %	***100%***	***14%***	***18%***	***39%***	***3%***	***6%***	***20%***	***0%***

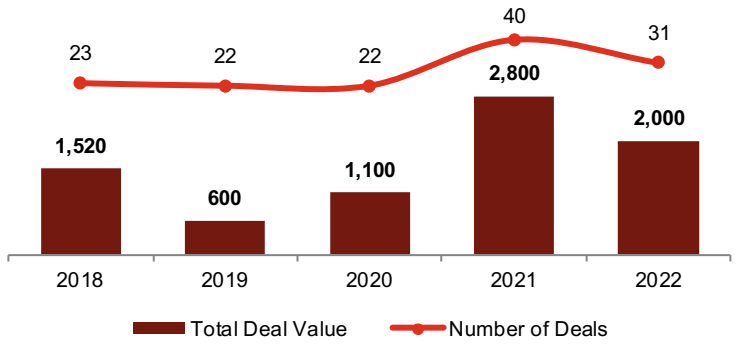
[1]LTM As of June 2023 – Data collected in August 2023

Source: Publicly Available Sources (As of August 2023), Capital IQ

In the last 2 years, the Turkish energy market experienced an increased level of M&A activity, with multiple transactions completed, which appeal to different points in the value chain.

Graph 108

Total Value (USD m) **and Number of Energy Deals in Türkiye**



Although the number of completed energy deals was stable from 2018 to 2020, the total deal value in USD terms observed a drop due to the USD/TL FX changes. The deal market started to recover with the ease of the pandemic in 2021, however, this spike could not be fully sustained in 2022 due to inflation and interest rates.

Çiftay

Peninsula Enerji → çiftay

- **Close Date:** TBA
- **Deal Perimeter:** 100%
- **Deal Value:** TBD
- **Implied EqV:** TBD

Buyer Description: Peninsula Enerji ve Teknoloji Yatırımları is a joint venture of Türkiye's Kuzu Group (40%) and Diar Süleymaniye Gayrimenkul (60%).

Target Description: The target includes Çiftay Madencilik's unlicenced SPP portfolio which has a total installed capacity of 100 MW. The SPPs are owned by 6 subsidiary companies of Çiftay Madencilik.

Enda Enerji Holding

MARGÜN → enda Enerji Holding AŞ

- **Close Date:** 23 Jan 2023
- **Deal Perimeter:** 30.39%
- **Deal Value:** TL 1b
- **Implied EqV:** TL 3.3bn

Buyer Description: Margün Enerji has operations in electricity generation, EPC, and maintenance. The company also focuses on hydroelectric, wind, and geothermal power generation.

Target Description: Enda Enerji Holding owns 4 HPPs, 5 WPPs, and 1 GPP with a total installed capacity of 189.63 MW. A total of 145.55 MWh of electricity generated from the aforementioned plants could be sold under YEKDEM.

Soli GES A.Ş.

İŞ ENERJİ → Soli GES A.Ş.

- **Close Date:** 28 Dec 2022
- **Deal Perimeter:** 50%
- **Deal Value:** n.d.
- **Implied EqV:** n.d.

Buyer Description: Founded in August 2022, İş Enerji aims to control a portfolio focusing on renewable energy investments.

Target Description: Soli GES A.Ş. is founded by Aldo Enerji with the aim of controlling the shares of 38 SPPs across Türkiye. İş Enerji has acquired 50% of the target as the first step, and both İş Enerji and Aldo Enerji will be jointly controlling Soli GES A.Ş.

Adularya Lignite-Fired PP

Doruk Madencilik → Adularya Lignite-Fired PP

- **Close Date:** 27 Dec 2022
- **Deal Perimeter:** 100%
- **Deal Value:** USD 177m
- **Implied EqV:** USD 177m

Buyer Description: Doruk Madencilik engages in mining activities as well as electricity production.

Target Description: The 2 x 145 MW Adularya Yunus Emre lignite-fired plant, which were initially transferred to Turkish Savings Deposit Insurance Fund, were sold to Doruk Madencilik through a public tender.

Source: PwC Analysis, Company Websites

Among the combined 71 deals completed in 2021 and 2022, the most significant in terms of total deal value included foreign buyers: British Actis LLP's majority stake acquisition of Uluğ Enerji in 2021 and Emirati IEH's 50% stakes acquisition of Kalyon Enerji in 2022.

ZES + Zorlu Enerji

- **Close Date:** 27 Sep 2022
- **Deal Perimeter:** n.d./12%
- **Deal Value:** USD 50m/38m
- **Implied EqV:** USD 316m

Buyer Description: Kuwait Investment Authority is the nation's sovereign wealth fund (SWF), and ranks 5th among all SWFs.

Target Description: ZES NV is an EV charging infrastructure company. Zorlu Enerji is a diversified energy company with operations in renewable energy, natural gas distribution, power distribution/sales & trade in Türkiye

Kalyon Enerji Yatırımları

- **Close Date:** 11 Aug 2022
- **Deal Perimeter:** 50%
- **Deal Value:** USD 490m
- **Implied EqV:** USD 980m

Buyer Description: Based in the UAE, IEH executes strategic investments in the energy, utilities & resources industry.

Target Description: Kalyon Enerji focuses on clean and renewable energy resources, and its investments include the Karapınar YEKA-1 SPP with 1,000 MW installed capacity in Konya and other renewable projects in Türkiye.

AKCEZ

- **Close Date:** 1 Aug 2022
- **Deal Perimeter:** 50%
- **Deal Value:** n.d.
- **Implied EqV:** n.d.

Buyer Description: Torunlar Holding is mainly focused on investments in real estate; however, the Group has also expanded its investments into the energy sector.

Target Description: AKCEZ controls the electricity distribution in Sakarya, Kocaeli, Bolu, and Düzce regions through its subsidiaries SEDAŞ and SEPAŞ. SEDAŞ serves approximately 2 million customers as electricity distributor.

Uluğ Enerji Dağıtım

- **Close Date:** 30 Sep 2021
- **Deal Perimeter:** Majority Stake
- **Deal Value:** n.d.
- **Implied EqV:** n.d.

Buyer Description: Actis LLP is a global investor in sustainable infrastructure with a particular focus on energy, digital & real estate.

Target Description: Uluğ Enerji holds the licence to operate UEDAŞ and owns Uludağ Elektrik. The possession of both of these firms allow the target to serve approximately 3 million customers in Bursa, Çanakkale, Balıkesir, and Yalova regions.

Süloğlu WPP

- **Close Date:** 19 Aug 2021
- **Deal Perimeter:** 100%
- **Deal Value:** n.d.
- **Implied EqV:** n.d.

Buyer Description: Entek Elektrik, a subsidiary of Tüpraş, engages in local and international renewable energy resource investments.

Target Description: Süloğlu WPP is located in Edirne region, and has an installed capacity of 66 MW. The WPP is acquired by Entek via a share transfer method.

Boyut Enerji

- **Close Date:** 17 Aug 2021
- **Deal Perimeter:** 100%
- **Deal Value:** TL 3m
- **Implied EqV:** TL 3m

Buyer Description: Turkcell Enerji (enerjicell) operates as a electricity supplier and has obtained a electricity supply licence from EMRA.

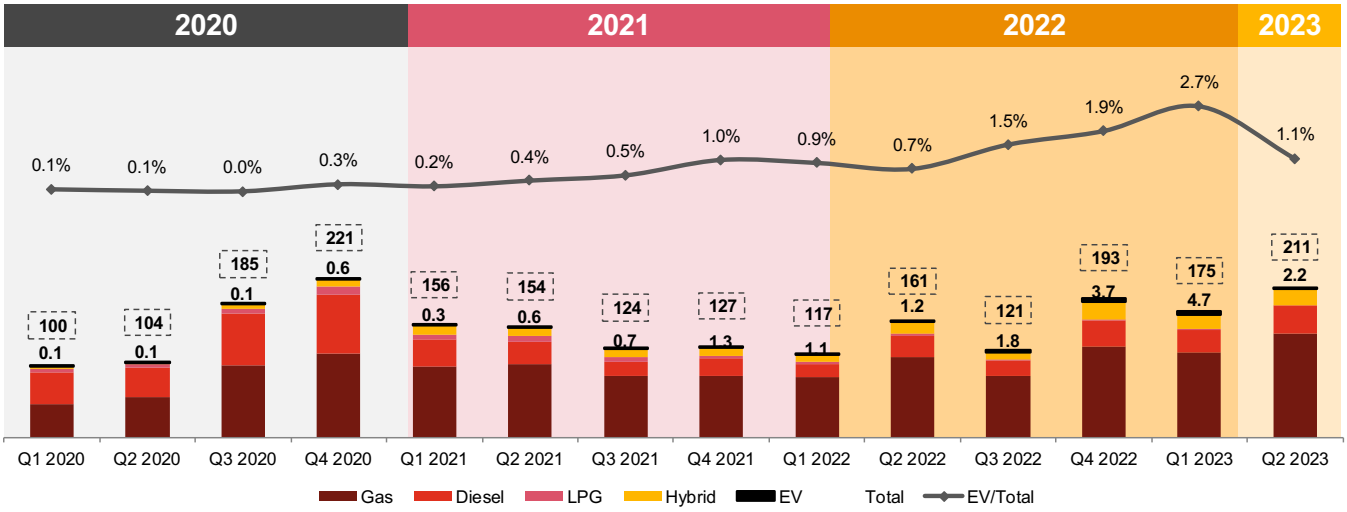
Target Description: Boyut Enerji owns the Karadağ WPP, which is located in İzmir and has an installed capacity of 18 MW. The WPP is included under the YEKDEM FiT until 2026.

Source: PwC Analysis, Company Websites

Even though the passenger car sales remained relatively constant between 2020 and 2022, the share of electric vehicles in total annual passenger car sales has risen steadily from 0.1% to 1.1% in the same period.

Graph 109

Passenger Car Sales by Engine Type in Türkiye (Thousands) & Share of EV (%)



EV Sales in Türkiye & New Entrants

The total number of EV sales in Türkiye has jumped from approximately 1,000 EVs to 8,000 between 2020 and 2022. In addition, the percentage of EVs to total passenger car sales has also spiked due to the advancement of the EV and battery technologies, as well as certain incentives, such as reductions in the Special Consumption Tax.

In the Turkish EV market, Chinese Skywell entered the market in 2022 and attained strong sales figures in its debut year. In 2023, TOGG and Tesla are the new entrants to the Turkish EV market. Local producer TOGG enjoys VAT and customs tax exemption while Chinese EV imports are subjected to an additional 40% customs tax.

Top 4 EV Sales By Brand (2022)

Mercedes	1559
BMW	1502
RENAULT	1155
SKYWELL	1150

Türkiye's 2030 Goals in EV & Charging

As stated in the Turkish National Energy Plan, it is expected that electric vehicles will account for **25%** of the **market share by 2030**, and the **EV stock** will reach **1.6m**. To accommodate the EV fleet, the goal is to **establish 100,000 EV charging stations**.

This raise in the number of charging stations and EV sales is expected to be boosted by the increased sales activity of TOGG and other foreign EV brands.

TOGG

Türkiye's Automobile Joint Venture Group (TOGG) invests in the development of a new domestically produced EV which was first delivered in April 2023.

TOGG is supported by the Turkish Government in the form of tax exemptions and necessary infrastructure R&D.

Production Facility: Bursa/Gemlik

Source: ODMD, TEHAD, EMRA, MENR

Charging Services Draft Regulation (published on April 2, 2022) and Car Park Regulation (published on March 25, 2021) are considered to be legal pillars of Electric Vehicle (EV) charging business in Türkiye.

Charging Services Draft Regulation

The draft regulation provides specifications regarding the procedures and processes of charging unit installations, operational features charging networks and provision of charging services.

Key remarks from the Regulation:

- **Minimum** number of required installed charging units is determined as **50** and (**5%** of the chargers in the network must be DC while at least **75%** of chargers at highways must be DC.
- Price for charging services are **determined freely** and is based on the energy **(per kWh)** transferred to EV.
- **Loyalty contracts** can be formed and consumers can be charged different prices based on the scope of the loyalty program.

Car Park Regulation

Amended in early 2021 by the Ministry of Environment, Urbanization and Climate Change, Car Park Regulation has touched on the regulations regarding the electric vehicle charging for the first time.

Key remarks from the Regulation:

- At least **5%** of the parking lots in a building with required number of parking lots exceed **20**, must be suitable electric vehicles and have charging units
- At least **10%** of the parking lots in a newly built district, general and mall car parks must be suitable for EVs and have charging units
- **At least one** of the charging units installed in malls larger than **30,000 m²** and **at least two** in malls larger than **70,000 m²** must have a fast charging (DC) capacity.

Major Players in the Turkish EV Charging Market

All EV charging companies should receive a Charging Network Operator Licence from EMRA, which allows the holder to operate an EV charging network and determine electricity prices freely. As of June 2023, EMRA has awarded licences to 130 companies. **Zorlu Energy Solutions (ZES)** and **Eşarj** are the two largest EV charging network operators in Türkiye.

ZES – Zorlu Energy Solutions

- **Founded:** 2018
- **Total Charging Ports[1]:** 1,773
- **AC Charging Ports[1]:** 1,663
- **DC Charging Ports[1]:** 110

Eşarj

- **Founded:** 2008
- **Total Charging Ports[1]:** 1,021
- **AC Charging Ports[1]:** 168
- **DC Charging Ports[1]:** 853

Other Market Players

Güzel Enerji Akaryakıt, SarJET, CW Enerji, enyakıt, VOLTRUN, ARMATEC, SHARZ.NET, WAT, kalyon EV, RHG ENERTÜRK ENERJİ

[1]As of June 2023

Source: Official Gazette, Company Websites, PwC Analysis

Electricity storage is regulated by the relevant legislation in Türkiye, published on the Official Gazette No: 31479, dated 9 May 2021. EMRA started accepting pre-licence applications for electricity storage facilities in November 2022 and awarded the first licence in April 2023.

According to the legislation on the regulation of electricity storage activities, 4 different types of electricity storage facilities could be installed: **independent facility**, **facility integrated to a production plant**, **facility integrated to a consumption facility**, and **facility installed by a grid operator**. The following requirements apply for each facility type:

1 Independent Facility	Requires obtaining a supplier licence and possessing an installed capacity of at least 2 MW.
2 Facility Integrated to a Production Plant	Requires possessing a production licence from EMRA and possessing an installed capacity not greater than the capacity of the licenced production plant.
3 Facility Integrated to a Consumption Facility	Requires the approval of the grid operator and possessing an installed capacity not greater than the contracted capacity of the consumption facility.
4 Facility Installed by a Grid Operator	Requires possessing a production licence from EMRA and possessing an installed capacity not greater than the capacity of the licenced production plant.

Most Utilized Facility Types

The majority of the electricity storage facilities fall within the first two categories and are integrated to a solar or a wind power plant.

According to EMRA, the investment for SPP/WPP's with an integrated storage facility has faced a sharp increase since the start of the acceptance of pre-licence applications, with all applications having a combined installed capacity in excess of **275 GW**.

Total Pre-Licencing & Future Goals

As of June 2023, the Turkish Wind Energy Association (TWEA) expects that the total pre-licenced capacity for integrated WPPs would reach approximately **18.5 GW**.

EMRA indicated that the total installed capacity of pre-licenced plants at the end of June 2023 neared **20 GW** and signified a total investment of approximately **USD 18bn**.

Source: Official Gazette, EMRA, TWEA, PwC Analysis

As of June 2023, approximately 270 pre-licences have been granted by EMRA. Integrated WPPs exceeded integrated SPPs in terms of both the number of licences granted and total pre-licenced capacity. Major publicly-held players in the industry have also announced significant investments in the electricity storage pre-licencing.

Figures on Integrated WPP/SPP Facilities

Application	Integrated WPP	Integrated SPP
5,000+ Pre-Licence Applications	**~ 120** Pre-Licenced Int. WPP	**~ 150** Pre-Licenced Int. SPP
~ 17.5 GW Pre-Licenced Capacity	**~ 8.5 GW** Pre-Licenced Capacity	**~ 9 GW** Pre-Licenced Capacity

akfen YENİLENEBİLİR ENERJİ[1]	205 MW	30 MW
aksa ENERJİ	411 MW	150 MW
Aydem yenilenebilir enerji	100 MW	400 MW
ENERJİSA Türkiye'nin Enerjisi	130 MW	200 MW
ENTEK	326 MW	
GALATAWIND	300 MW	50 MW
yeo		225 MW
ZORLU ENERJİ	375 MW	

[1]Akfen has also announced a 380 MW-capacity independent facility approval by EMRA
Source: EMRA, Company Announcements, PwC Analysis

Several energy, technology, and automotive companies have started to shift their focus in battery manufacturing facilities and increased the pace of their processes in facility investments in Türkiye.

Reap Battery

Reap Battery is founded as a subsidiary of YEO Teknoloji to develop energy storage technologies by investing in a new production facility in İstanbul/Tuzla.

Investment End: 2028
Current Stage: Phase 1
Planned Capacity: 1 GWh

Product Spectrum: Utility-Scale Energy Storage Solution Systems

Pomega Energy Technologies

A subsidiary of Kontrolmatik Technologies, Pomega undertakes a LFP Battery Cell and Energy Storage systems investment in Ankara/Polatlı.

Investment End: 2024
Current Stage: Phase 1
Planned Capacity: 2 GWh

Product Spectrum: LFP Battery Cell/Pack, Hybrid Energy Solutions, EV Charging Support Systems

Koç Holding – Ford – LG Energy Solution

Koç Holding, Ford, and LG Energy Solution signed a Memorandum of Understanding in February 2022 to invest in a battery cell production facility. **Although signed, the MoU is non-binding.**

Investment End: 2029
Current Stage: Not Started
Planned Capacity: 45 GWh

Product Spectrum: Electric Vehicle Battery Solutions

TEMSA

TEMSA has been conducting R&D activities and produces batteries and battery packs in its production plant in **Adana** since 2021, which are utilized in the electric vehicles produced by the company.

Ulu Motor - Skyworth

Ulu Motor and Skyworth, a subsidiary of EV-producer Skywell, has agreed to invest in a battery development and production facility in Türkiye. The feasibility study for the facility has been initiated.

Source: Company Announcements, PwC Analysis

Türkiye's nuclear power ambitions remain high, and nuclear energy has been on the country's radar since the 1960s. As of April 2023, Türkiye obtained the nuclear status since the 1st fuel delivery made for Akkuyu NPP.

TÜRKİYE ATOM ENERJİSİ KURUMU

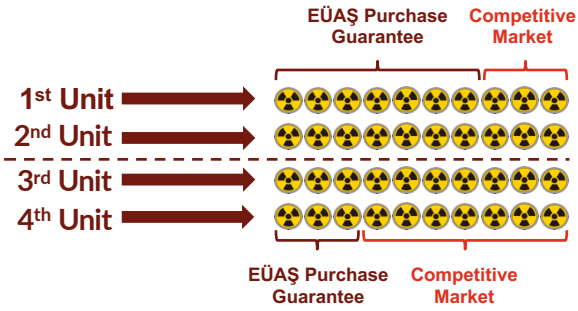
The introduction of nuclear energy into the energy mix has been among the central aims of Turkish energy policy in the last decades.

The **Atomic Energy Commission,** which was established in 1956, was renamed to the **Turkish Atomic Energy Authority (TAEK)** in 1982. The institution remains as the main body responsible for **regulation of the nuclear energy market**.

After several unsuccessful attempts at launching an NPP, the process restarted in 2006. The Law on the Construction and Operation of Nuclear Power Plants and Energy Sale was enacted in 2007, and companies were invited to submit bids for the construction of a NPP in Akkuyu. After the tender for Akkuyu was cancelled due to lack of competition in 2009, the government decided to engage in direct talks with the Russian government. As a result of these negotiations, an intergovernmental agreement for the construction of a **4,800 MW** NPP in Akkuyu was signed between the two countries in 2010.

According to the international agreement between Türkiye and Russia, EÜAŞ is set to buy **70% of the generation from the first two units and 30% of that of the third and fourth units** of the Akkuyu NPP at a price of **123.5 USD/MWh** for a period of **15 years** following the commissioning of each unit.

Purchase Guarantees for Akkuyu



In addition to being Türkiye's first NPP, Akkuyu is the world's first NPP Project implemented through a Build – Own – Operate (BOO) model. The first reactor is planned to become operational in 2023, with the remaining three reactors to be commissioned at one-year intervals, that is, in 2024, 2025 and 2026, and eventually reach total installed capacity of 4,800 MW. The plant is expected to employ approximately **4,000** operational personnel and aims to supply **10%** of Türkiye's electricity demand.

In addition to Akkuyu, there are plans to establish two additional nuclear power plants, located in Sinop and Kırklareli provinces. Similar to Akkuyu NPP, both projects expected to have the installed capacity of approximately 5 GW.

Source: TAEK, EÜAŞ, WNA, ROSATOM, Publicly Available Sources

Glossary of Terms and Abbreviations

Name	Description
%	Percent
#	Number
1M20	First Month of 2020
1H20	First Half of 2020
1H21	First Half of 2021
1Q22	First Quarter of 2022
AC	Alternating current
bcm	Billion Cubic Meters
bn	Billion
BAU	Business- As-Casual
BOO	Build-Operate-Own
BOT	Build-Operate-Transfer
BOTAŞ	Petroleum Pipeline Corporation
BP	The British Petroleum Company
BPM	Balancing Power Market
BPP	Biothermal Power Plant
c.	Circa
cm	Centimeter
cm3	Cubic centimeter
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CAT	Climate Action Tracker
CBRT	Central Bank of the Republic of Turkey
CCGT	Combined Cycle Power Plant
CNG	Compressed Natural Gas
CERN	European Organization for Nuclear Research
CO2	Carbon Dioxide
COD	Commercial Operation Date
Covid-19	Coronavirus Disease 2019
CPI	Consumer Price Index
DAP	Day Ahead Price
DAM	Day Ahead Market
DAMP	Day Ahead Market Prices
DC	Direct current
DIP	Daily Index Price
DRP	Daily Reference Price
DSI	State Hydraulic Works
DSO	Distribution System Operator
EML	Electricity Market Law
EMRA	Energy Market Regulatory Authority
ENTSO-E	European Network of Transmission System Operators

Glossary of Terms and Abbreviations

Name	Description
EPİAŞ	Energy Exchange İstanbul
ESG	Environmental, Social and Corporate Governance
ETS	Emissions Trading System
EU	European Union
EÜAŞ	Electricity Generation Company
EXIST	Energy Exchange Istanbul
EUROSTAT	Statistical Office of European Commission
EUR	Euro
EV	Electric Vehicle
EPC	Engineering Procurement and Construction
EqV	Equity Value
FDPP	Final Daily Production Program
FX	Foreign Exchange
FiT	Feed-in-Tariff
FSRU	Floating Storage Regasification Unit
GAZBİR	Natural Gas Distribution Companies Association of Turkey
G.D	Gross Demand
GDP	Gross Domestic Product
GFM	Gas Futures Market
GPPE	Gross Property Plant Equipment
GHG	Greenhouse Gas
GPP	Geothermal Power Plant
GW	Gigawatts
GWh	Gigawatt hour
HEPI	Household Energy Price Index
HPP	Hydro Power Plant
HZ	Hertz
ICE	Intercontinental Exchange
IDM	Intra Day Market
IPO	Initial Public Offering
IGDAS	İstanbul Gaz Dağıtım Sanayi ve Ticaret Anonim Şirketi
IDM	Intra-Day Market
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
km	Kilometers
kr	kuruş
kWh	Kilowatt Hours
LNG	Liquefied Natural Gas
LLP	Limited Liability Partnership

Glossary of Terms and Abbreviations

Name	Description
LPG	Liquefied Petroleum Gas
LTM	Last Twelve Months
LULUCF	Land use, land-use change and forestry
m	Million
m3	Cubic meter
M.Cap	Market Capitalization
MENR	Ministry of Energy and Natural Resources
Mt	Million Tons
MVA	Megavolt Amperes
MW	Megawatts
MWh	Megawatt Hours
MSP	Maximum Settlement Price
n.a	Not Available
NDC	Nationally Determined Contribution
NG	Natural Gas
NGO	Non-Governmental Organisation
NBP	National Balancing Point
NPPE	Net Property Plant Equipment
NPP	Nuclear Power Plant
N.T	Net Trade
ODMD	Automotive Distributors Association
OECD	Organization for Economic Co-operation and Development
OPEX	Operational Expenses
OTC	Over the Counter
OTSP	Organized Wholesale Gas Trading Platform
PFC	Primary Frequency Control
PPI	Purchase Price Index
PP	Power Plant
PPA	Purchase Price Agreement
PPE	Property, Plant & Equipment
PPP	Public Private Partnership
PwC	PwC: Audit and Assurance, Consulting and Tax Services
R&D	Research & Development
SGM	Spot Gas Market
SFC	Secondary Frequency Control
SWF	Sovereign Wealth Fund
SME	Small and Medium Sized Enterprises
SPP	Solar Power Plant
TAEK	Turkish Atomic Energy Authority
Tn	Tone
Tcm	Thousand Cubic Meters

Glossary of Terms and Abbreviations

Name	Description
TANAP	Trans-Anatolian Natural Gas Pipeline Project
TEAŞ	Turkish Electricity and Transmission Company
TEDAŞ	Turkish Electricity Distribution Company
TEHAD	Turkish Electric & Hybrid Vehicles Association
TEİAŞ	Turkish Electricity Transmission Company
TEK	Turkish Electricity Administration
TETAŞ	Turkish Electricity Trading and Contracting Company
TTF	Title Transfer Facility
TWEA	Turkish Wind Energy Association
THE	Trading Hub Europe
TL	Turkish Lira
TOR	Transfer Operating Rights
TPAO	Turkish Petroleum Corporation
TPP	Thermal Power Plant
TOGG	Türkiye's Automobile Joint Venture Group
TSO	Transmission System Operator
TUIK	Turkish Statistical Institute (TURKSTAT)
TW	Terawatts
TWh	Terawatt Hours
UK	United Kingdom
USD	United States Dollars
VAT	Value-Added Tax
VCS	Verified Carbon Standard
WPP	Wind Power Plant
WTO	World Trade Organization
YEKA	Renewable Energy Resource Areas
YEKDEM	Renewable Energy Supporting Mechanism
YEK-G	Renewable Energy Resource Guarantee Certificate
YETA	Green Tariffs
ZES	Zorlu Energy Solutions