ENERGY OUTLOOK

2020

TSKB

CONTRIBUTING DEPARTMENTS

Development Finance Institutions
Economic Research
Engineering and Technical Advisory
Escarus (TSKB Sustainability Consultancy)
Loan Analysis
Project Finance

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Abbreviations

BCM: Billion Cubic Meters
BDLH: Bunker Delivery Petroleum Pipeline Corporation License Holders
BOTAŞ: Petroleum Pipeline Corporation
BP: British Petroleum
BPP: Biomass Power Plant
CBRT: Central Bank of the Republic of Turkey
CETC: China Electronics Technology Group Corporation
COP: Conference of the Parties
DFI: Development Finance Institutions
EBP: Efficiency-boosting Project
ECA: Export Credit Agencies
EEED: Energy Efficiency and Environment Department
EEZ: Exclusive Economic Zone
EIA: U.S. Energy Information Administration
EML: Electricity Market Law
EMRA: Energy Market Regulatory Authority
ENVER: Energy Efficiency Association
EPC: Engineering, Procurement and Construction
EXIST: Energy Exchange İstanbul
EU: European Union
EÜAŞ: Electricity Generation Company
FSRU: Floating Storage and Regasification Unit
GCASC: Greek Cypriot Administration of Southern Cyprus
GDP: Gross Domestic Product
GPP: Geothermal Power Plant
GW: Gigawatt
GWh: Gigawatthour
HEPP: Hydroelectric Power Plant
IEA: International Energy Agency
IMF: International Monetary Fund
IPCC: Intergovernmental Panel on Climate Change
kW: Kilowatt
kWh: Kilowatthour
LCOE: Levelized Cost of Energy
LNG: Liquefied Natural Gas
Lt: Liter
MCM: Million Cubic Meters
MCP: Market Clearing Price
MENR: Ministry of Energy and Natural Resources
MTOE: Million Tonnes of Oil Equivalent
MW: Megawatt
MWh: Megawatthour
NaS: Sodium Sulfur
NEEAP: National Energy Efficiency Action Plan
OECD: Organization for Economic Co-operation and Development
OIZ: Organized Industrial Zone
OPEC: Organization of the Petroleum Exporting Countries
PHEPP: Pumped Storage Hydroelectric Power Plant
PV: Photovoltaic
SCT: Special Consumption Tax
SMP: System Marginal Price
SPP: Solar Power Plant
SPPA: Solar Power Potential Atlas
TANAP: Trans-Anatolian Natural Gas Pipeline
TEK: Turkish Electricity Authority
TEAŞ: State Electricity Generation and Transmission Corporation
TEDAŞ: Turkish Electricity Distribution Corporation
TEHAD: Turkey Electric & Hybrid Vehicles Association
TEİAŞ: Turkish Electricity Transmission Company
TETAŞ: Turkish Electricity Trade and Contracting Company
TOGG: Turkey's Automobile Joint Venture
TPAO: Turkish Petroleum Corporation
TPP: Thermal Power Plant
TPNC: Turkish Republic of Northern Cyprus
TSKB: Industrial Development Bank of Turkey
TÜPRAŞ: Turkish Petroleum Refineries Corporation
TWh: Terawatthour
UNCLOS: United Nations Convention on the Law of the Sea
UNEP: United Nations Environment Programme
UNFCCC: United Nations Framework Convention on Climate Change
USA: United States of America
USSR: Union of Soviet Socialist Republics
WHO: World Health Organization
WMO: World Meteorological Organization
WPP: Wind Power Plant
YEK: Law on the Use of Renewable Energy Sources for the Generation of Electric Energy
YEKA: Renewable Energy Resource Area
YEKDEM: Renewable Energy Resources Support Mechanism
YETA: Renewable Energy Supply Agreements

Executive Summary

There is no doubt that 2020 has been arduous and exhausting for both the world and Turkey. Some chronic problems (low rate of savings, rising foreign resource dependency, insufficiency of value-added production, lack of innovation) and some relatively-acute problems (weakening in the debt service coverage of the private sector, rising inflation, increasing unemployment, etc.) experienced in Turkish economy during 2019 paved the way for attributing new meanings to 2020 for building a robust and stable development route. In fact, the first few months of 2020 witnessed some promising developments in terms of economy. However, the Covid-19 pandemic's disruptive impact on economic activities and crippling impact on certain business lines have deeply affected Turkey just as many other geographies across the globe. Initially hitting economic activities in the form of short but frequent waves just above the surface and paused growth, the Covid-19 pandemic quickly turned into a tsunami with its rapid spreading potential and shocked national economies one after another. Suffering from various economic vulnerabilities due to its structural problems and nevertheless aiming to achieve prosperity by going through challenging times, Turkey has become one of the countries caught relatively unprepared against the shock wave caused by the Covid-19.

Directly affecting all business lines and sectors from agriculture to transportation, logistics and tourism and constituting a multi-layered and multi-dimensional structure due to its nature, the energy sector gives supply security a more central role in regions and countries with a modern lifestyle and increased technological complexity. Energy hunger and permanent energy deprivation aside, even the inability to supply energy for several consecutive days is considered one of the staggering disaster scenarios almost all over the world. Therefore, the entire planning in modern energy systems is structured over a scenario in which demand grows uninterruptedly, and the whole chain from the design of investments to the provision of services is shaped around this principle. A demand standstill, especially a decline, causes the disruption of usual orders and the emergence of new ways of thinking and doing business.

The slowdown and relative decline of economy in Turkey just as in the entire world in 2020 has solidified recent negative trend regarding energy demand. Impacts of climate-related risks that are gradually felt more deeply have sparked the discussion of the energy sector more than ever as it constitutes the major source of emission. All these developments have created an opportunity for rethinking from scratch about the components of the energy sector.

Recent economic fluctuations have resulted in certain stagnation concerning the growth of electricity and natural gas demand in Turkey. Consecutive decline in natural gas consumption in 2018 and 2019 has not achieved an upward trend in 2020 as understood from the data of the first 3 quarters. As for the electricity demand with no growth in 2019, it is understood that 2020 is not a promising year. Capacity increases in the electricity market have continued in recent years but initial slowdown and subsequent cessation in demand have led to a considerable excess supply. This requires the skillful management of the existing installed capacity of Turkey for electricity and the formulation of the market equation as "a game with many winners". This orchestration, which is difficult but still feasible, is of great importance, especially for the financial sustainability of the players in the electricity market and partially those in the natural gas market. Published for the third time, this year, the "Energy Outlook" report offers a detailed analysis of various sub-components of the energy sector (electricity, natural gas, oil, renewable energy and energy efficiency) as in the past two years and gives an overview of the dominant and decisive trends in the energy market. In line with the feedback for previous years' reports, "energy investments and financing" has been covered as a separate subject in the 2020 report. Another important point that distinguishes this year's report from the previous ones is that, apart from the analyses on energy sub-sectors, thematic titles are presented in a complementary way and as separate sub-sections.

As specified above, "the emergence of an environment suitable for rethinking from scratch about the components of the energy sector" due to the Covid-19 pandemic has brought about such a pursuit. Thematic titles of this year's report are the short-term impact of the Covid-19 on the energy sector, Turkey's hydrocarbon explorations, developments regarding the Renewable Energy Resource Areas (YEKA) and the Renewable Energy Resources Support Mechanism (YEKDEM), rooftop and facade solar power systems, hybrid technologies, battery storage systems, electric vehicles, emissions as a national projection of energy-climate nexus and climate actions. A series of themes from digitalization in the energy sector to demand-side management, hydrogen energy and carbon sequestration technologies have been excluded from the report by considering the diversity and heterogeneity of the report's target group. The fact that they are not mentioned in this report, of course, does not mean that these subjects are not important. The course of developments at global and national level will continue to be the main determinants for a closer examination of such themes.

Summarizing concrete developments in the energy sector of Turkey from a macro perspective, this report draws the attention of readers to some arguments about the direction and horizon of developments in the evidence of the findings obtained through thematic studies. Written with both a modular and integrated manner, the report can be read from the beginning to the end while it is also possible to focus on certain titles depending on the fields of special interest. It is predicted that the dynamics outlined in the report will be discussed more in 2021, when certain challenges will likely to continue.

Energy Sector Outlook for 2020

This report has been issued by TSKB Energy Working Group and aims to assess the dynamics, developments and expectations in the energy sector which supports a great many high added value sectors and makes a close and direct impact on operations in those sectors.

This section of the report examines as main themes the components of the Turkish energy sector, the trends and expectations of energy markets as well as energy investments and financing. It covers the sub-sectors of electricity, natural gas, oil, renewable energy and energy efficiency in Turkey.

1.1. Electricity Outlook

Turkish electricity sector has developed through the principle of supply security at its heart and with an aim to contribute to economic growth and national prosperity. For long years, power services in Turkey had been delivered by a public institution operating within a vertically integrated structure. In the 1990s, power generation and distribution operations were separated, followed by the attempts to include private sector companies in investment and operation processes and the use of various models to that end. In the early 2000s, some legal regulations were launched and resolute liberalization steps were taken, triggering an evolution in the electricity sector into the current competitive, multi-player model where operations are segregated.

1.1.1. Current Market Structure in Turkey

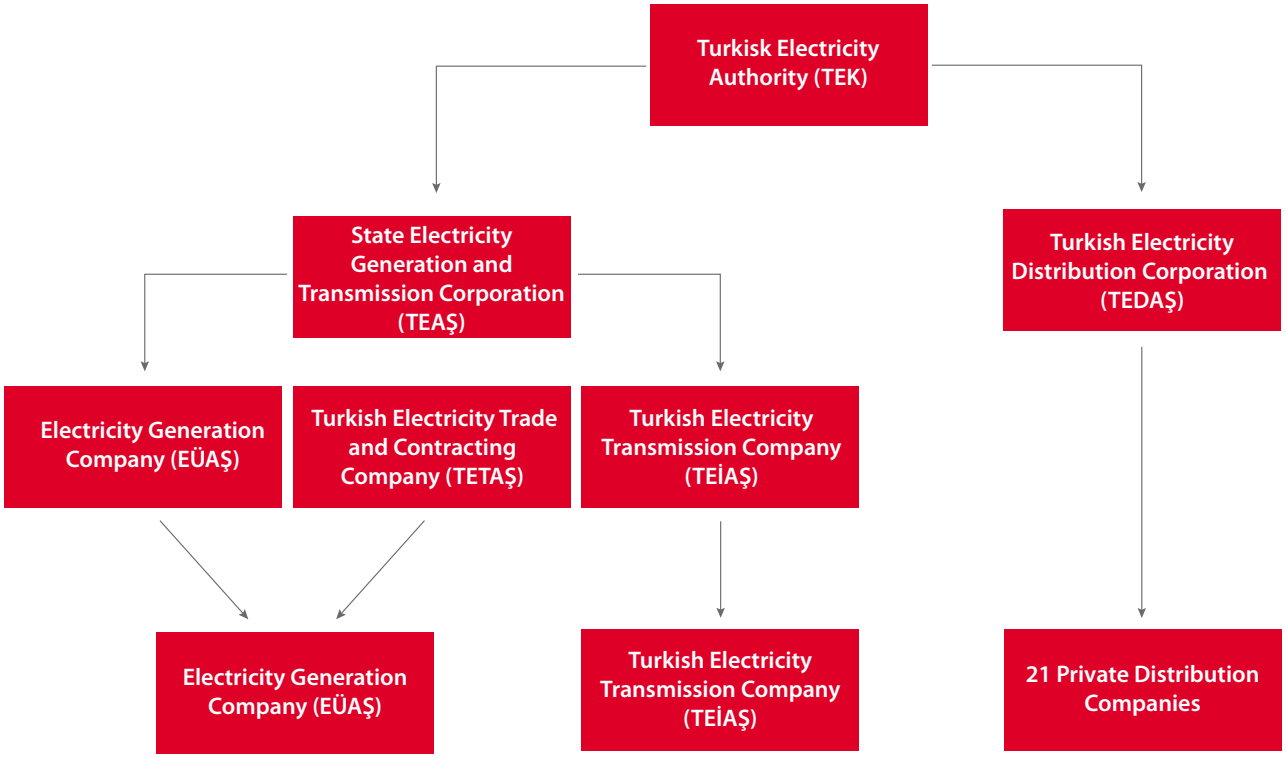
Development and liberalization of the electricity market in Turkey started with the entry into force of the Electricity Market Law (EML) in 2001. Prior to this period, the market was controlled by public institutions such as the Turkish Electricity Authority (TEK) and the Ministry of Energy and Natural Resources (MENR) and market openness was quite limited. Established in 1970, TEK was divided into two institutions in 1994: Turkish Electricity Distribution Corporation (TEDAŞ) and State Electricity Generation and Transmission Corporation (TEAŞ).

Although attempts were made to divide generation and distribution activities for the purposes of liberalization in the 1990s, the actual liberation was initiated with the division of TEAŞ into three separate companies, namely Turkish Electricity Transmission Company (TEİAŞ), Electricity Generation Company

(EÜAŞ) and Turkish Electricity Trade and Contracting Company (TETAŞ), the establishment of the Energy Market Regulatory Authority (EMRA) and the publication of the EML No. 4628. In the subsequent 19 years, the electricity sector has turned into a multi-actor sector and an environment where free market competition is predominant.

Established for liquidation following the reduction of stranded cost impacts of purchasing guarantee projects and assigned for the trade and commitments intended for electric energy, TETAŞ was closed down in 2018 after its powers and assets were transferred to EÜAŞ. An analysis of current ownership status regarding generation plants shows that the public power plants are affiliated to EÜAŞ and the public share within the installed capacity declined from 80% to 20% in years. TEİAŞ's responsibility is to operate the current system and operate the balancing power market and ancillary services market.

Figure 1: Institutions in the Turkish Electricity Sector



Privatization process for 20 distribution zones owned by TEDAŞ responsible for electricity distribution (within the scope of the Law No. 4046 on Privatization Practices) started in 2009 with the transfer of Başkent Elektrik Dağıtım A.Ş. to Enerjisa Elektrik Dağıtım A.Ş. and came to an end in 2013 with the transfer of Toroslar Elektrik Dağıtım A.Ş. to Enerjisa Elektrik Dağıtım A.Ş. Thus, all of 21 electricity distribution companies including Kayseri ve Civarı Elektrik Türk A.Ş. operating under a private company since 1990 within the scope of the Law No. 3096 are now operated by the private sector.

The institutions and organizations mentioned in Figure 1 are involved in generation, transmission and distribution while Energy Exchange İstanbul (EXIST) was established in 2015 for market operations. Within the framework of the Electricity Market Law No. 6446, the duty of EXIST is to operate the organized wholesale electricity market and manage market transactions defined as financial settlement transactions within the market. The new intra-day market introduced by EXIST allowed for intra-day projections regarding power plants generating irregular electric power from renewable energy resources.

Table 1: Electricity Distribution Zones

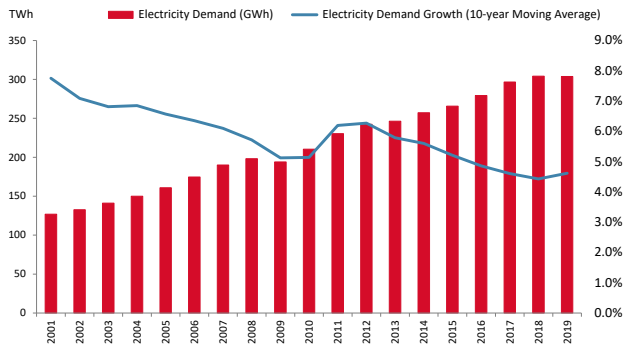
Electricity Distribution District	Provinces Covered	Companies Winning the Tender
Dicle Elektrik Dağıtım A.Ş.	Diyarbakır, Şanlıurfa, Mardin, Batman, Siirt, Şırnak	İşkaya Doğu OGG
Vangölü Elektrik Dağıtım A.Ş.	Van, Bitlis, Hakkâri, Muş	Türkerler İnşaat
Aras Elektrik Dağıtım A.Ş.	Erzurum, Ağrı, Ardahan, Bayburt, Erzincan, Iğdır, Kars	Kiler Holding
Çoruh Elektrik Dağıtım A.Ş.	Trabzon, Artvin, Giresun, Gümüşhane, Rize	Aksa Enerji
Fırat Elektrik Dağıtım A.Ş.	Elâzığ, Bingöl, Malatya, Tunceli	Aksa Enerji
Çamlıbel Elektrik Dağıtım A.Ş.	Sivas, Tokat, Yozgat	Limak-Kolin-Cengiz
Toroslar Elektrik Dağıtım A.Ş.	Adana, Gaziantep, Hatay, Mersin, Osmaniye, Kilis	EnerjiSA
Meram Elektrik Dağıtım A.Ş.	Kırşehir, Nevşehir, Niğde, Aksaray, Konya, Karaman	Alarko-Cengiz
Başkent Elektrik Dağıtım A.Ş.	Ankara, Kırıkkale, Zonguldak, Bartın, Karabük, Çankırı, Kastamonu	EnerjiSA
Akdeniz Elektrik Dağıtım A.Ş.	Antalya, Burdur, Isparta	Limak-Kolin-Cengiz
Gediz Elektrik Dağıtım A.Ş.	İzmir, Manisa	Elsan-Tümaş-Karaçay
Uludağ Elektrik Dağıtım A.Ş.	Bursa, Balıkesir Çanakkale, Yalova	Limak-Kolin-Cengiz
Trakya Elektrik Dağıtım A.Ş.	Kırklareli, Tekirdağ, Edirne	İC Holding
Anadolu Yakası Elektrik Dağıtım A.Ş.	İstanbul Anatolian Side	EnerjiSA
Sakarya Elektrik Dağıtım A.Ş.	Sakarya, Bolu, Düzce, Kocaeli	AK Enerji
Osmangazi Elektrik Dağıtım A.Ş.	Eskişehir, Afyon, Bilecik, Kütahya, Uşak	Yıldızlar SSS
Boğaziçi Elektrik Dağıtım A.Ş.	İstanbul European Side	Limak-Kolin-Cengiz
Kayseri ve Civarı Elektrik Türk A.Ş.	Kayseri	Kayseri ve Civarı Elektrik Türk A.Ş.
Menderes Elektrik Dağıtım A.Ş.	Denizli, Aydın, Muğla	Aydem Elektrik-Bereket Enerji
Göksu Elektrik Dağıtım A.Ş.	Kahramanmaraş, Adıyaman	AKEDAŞ
Yeşilırmak Elektrik Dağıtım A.Ş.	Samsun, Amasya, Çorum, Ordu, Sinop	Çalık Holding

Source: EMRA, TSKB

1.1.2. Demand Analysis

The total demand for electricity in Turkey between 2000 and 2019, excluding the years 2011, 2009 and 2019, did not decline and maintained a constant increase. This proves that the demand for electricity in Turkey is closely associated with the country's gross domestic product (GDP) growth rate. Standing at 304.2 terawatthours (TWh) in 2018, the total demand for electricity materialized as 303.7 TWh as of the end of 2019.

Chart 1: Electricity Demand and 10-Year Moving Average Growth



Source: TEİAŞ, TSKB

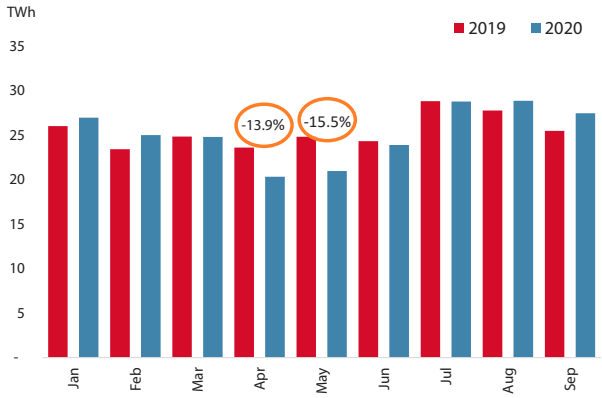
After a rise of 2.5% in 2018, there was a 0.2% decrease in 2019. An analysis of 10-year moving average values of Turkey's demand for electricity between 1985 and 2019 points to a general downward trend between 1993 and 2009 followed by an upward trend between 2010 and 2012 and back to a downward trend between 2013 and 2019.

Making a huge impact throughout the world in the beginning of 2020, the Covid-19 pandemic resulted in the gradual introduction of limitations and tight measures in Turkey from March 11, 2020 when the first Covid-19 case was announced to the end of May and many firms in manufacturing and services sectors had limited operations leading to periodic closures. Within the framework of these restrictions and tight measures, the demand for electricity decreased significantly in April and May year-on-year. With the relaxation of tight measures from June, the demand for electricity started to recover and reached the levels prevailing before the Covid-19 pandemic.

According to daily data, the daily demand for electricity broke a record in September.

Shrinkage that started in the last quarter of March resulted in a decrease of 0.2% for the demand for electricity in March year-on-year and the decline in the demand for electricity rose to 13.9% and 15.5% in April and May, respectively. Annualized negative growth concerning monthly demand for electricity started losing its impact due to the normalization steps announced in June and hot weather conditions prevailing across Turkey, turned into positive in August and maintained this positive trend until the end of September. Dropping by 0.1% in July at annual basis, the demand for electricity grew by 4.0% and 7.7% in August and September, respectively. An analysis of the sum of the first nine months as of the end of September reveals that the total demand for electricity stood at 227.2 TWh during January-September 2020, resulting in a decline of 0.9% year-on-year. A rise of 2% for the demand for electricity during the last quarter calculated through analyses means a total demand for electricity in 2020 at 0.2% less than the level in 2019. If the monthly demand for electricity in the last quarter is the same as the level in the last quarter of 2019, it is estimated that 2020 will be completed at 0.7% below the total demand for electricity in 2019.

Chart 2: Outlook of Monthly Electricity Demand

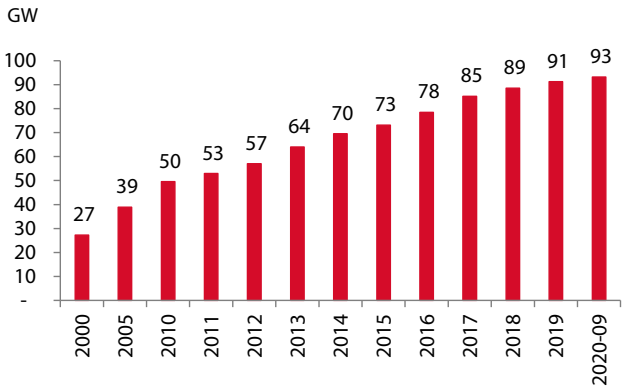


Source: TEİAŞ, TSKB

1.1.3. Installed Capacity Analysis

Turkey's total installed capacity was around 27.3 gigawatts (GW) as of 2000 but rose to 91.3 GW by the end of 2019. In recent years, the total installed capacity has improved considerably in the wake of increased incentives extended to power plants generating electricity from renewable energy resources and local resources.

Chart 3: Development of Turkey's Installed Capacity



Source: TEİAŞ, TSKB

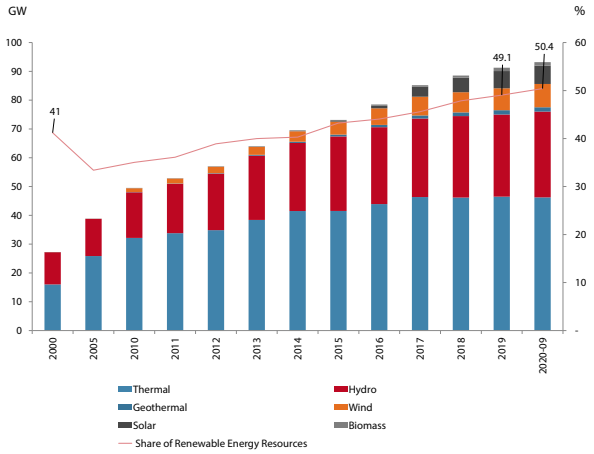
During 2011 and 2019, an average of 4.6 GW of installed power was commissioned each year. It is observed that the rise in installed capacity was higher than the total demand for electricity during this period and one of the major reasons is considered to be the incentives extended to renewable energy power plants. Annual average installed capacity of the renewable energy power plants commissioned between 2011 and 2019 stood around 3.0 GW. Total installed capacity for renewable energy sources rose around 3.5 GW in 2018 but the total installed capacity materialized around 3.4 GW due to the closure of some power plants. Total net installed capacity of thermal power plants decreased around 0.2 GW in 2018 while the share of wind and solar power plants in total installed capacity rose by 2.1 GW.

Total installed capacity of Turkey reached 93.2 GW by the end of the first nine months in 2020. The installed capacity increased by about 1,912 megawatts (MW) in the first nine months. This increase was attributable to power plants generating electricity from renewable resources. An installed capacity increase of 1,263 MW was achieved through hydroelectric power plants, 374 MW from wind power plants (WPP) and 237 MW from solar power plants (SPP). Net total installed capacity of power plants generating electricity by using natural gas and more than one fuel decreased by 291 MW during the relevant period.

The share of renewable energy resources in the total installed capacity has risen since 2005. Standing at 33% in 2005, the share of power plants generating electricity from renewable energy resources in the installed capacity rose to 49.1% in 2019. It is thought that YEKDEM played a decisive role in this rise. 63.7% of the renewable generation plants reached a total of 44.8 GW by the end of 2019 were composed of hydroelectric power plants (HEPP), 17% of WPPs and 13.4% of SPPs.

An analysis of the data regarding the first nine months of 2020 shows that the share of the power plants generating electricity from renewable energy resources in the installed capacity has risen to 50.4%. Commissioned in 2020, high-capacity HEPPs played a major role in this rise. Contribution of WPPs and SPPs experiencing difficulties in the supply of equipment manufactured abroad due to the Covid-19 pandemic to the installed capacity rise during the first nine months stood at a mere 0.9 GW. At 2018 year-end, the share of power plants owned by private companies in total installed capacity stood at 79.1% while the power plants of EÜAŞ, on the other hand, had a share of 20.9%. The share of EÜAŞ power plants rose to 21.5% in 2019. As of September 2020, the share of power plants owned by private companies in total installed capacity stood at 77.7% while the power plants of EÜAŞ, on the other hand, had a share of 22.3%. The share of EÜAŞ rose in the last two years mainly due to the completion of the contracts of build-operate-transfer and transfer-of-operating-rights power plants and the transfer of these facilities to EÜAŞ. As of September, the share of independent generation companies and unlicensed power plants in total installed capacity stood at 67.4% and 7.1%, respectively.

Chart 4: Development of Installed Capacity in Turkey by Resources and the Share of Renewable Energy Sources



Source: TEİAŞ, TSKB

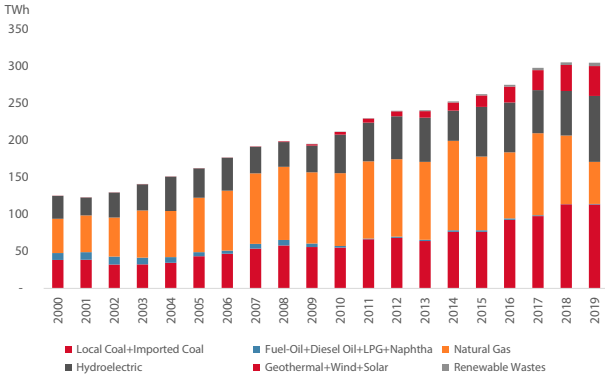
According to the Eleventh Development Plan covering objectives between 2019 and 2023, it is estimated that Turkey's total installed power will reach 109.5 GW by 2023.

1.1.4. Generation Analysis

In parallel with the changes regarding annual demand for electricity, generation decreased in 2001, 2009 and 2019 and followed a parallel course with the demand for electricity. Major investments have been made from the beginning of the 1980s so as to meet the rapidly-rising demand for electricity, thus leading to a considerable rise in the total gross electricity generation of Turkey. Shrinking by 1.8% in 2001 and 2009, the gross electricity generation decreased by 0.2% in 2019. Standing at 304.8 TWh in 2018, the gross electricity generation dropped to 304.3 TWh by the end of 2019.

In 2020, gross electricity generation declined in Turkey with the impact of a drop in the demand for electricity during March-June due to the Covid-19 pandemic. Decreasing by 0.6% in March year-on-year, the gross electricity generation declined by 14.6, 16.5 and 2.6% at annual basis in April, May and June, respectively. As of the end of September, the total gross electricity generation stood at 226.9 TWh, resulting in a decline of 1.1% year-on-year.

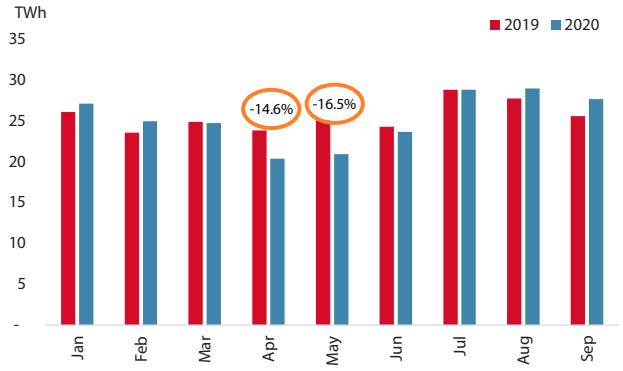
Chart 5: Gross Electricity Generation by Primary Source



Source: TEİAŞ, EMRA, TSKB

An analysis of the breakdown of fuels in the total installed capacity of Turkey and generation capacities for these fuels reveals an approximate annual project capacity of 489 TWh in Turkey by the end of 2019. Based on the reliable generation capacity of these projects, it is estimated that there is a generation potential of 413 TWh. Given that around 227 TWh of electricity was generated by the end of the first nine months in 2019, it is possible to say that Turkey has excess supply and any additional new capacity will increase this excess supply in case of limited rise in the demand for electricity.

Chart 6: Outlook of Monthly Gross Electricity Generation



Source: TEİAŞ, TSKB

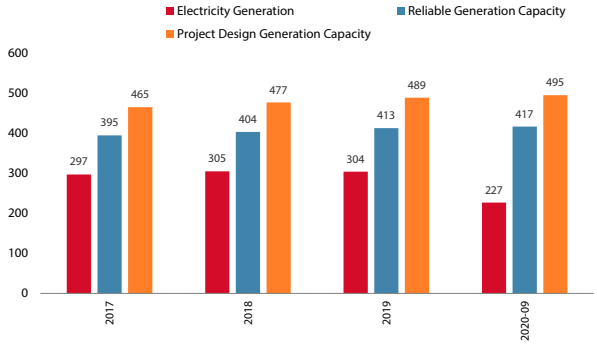
Gross electricity generation decreased due to the Covid-19 pandemic while the share of electricity generated from renewable energy sources rose to 46.5% in total. Therefore, it is considered that the power plants generating electricity from renewable energy resources maintained and fortified their position throughout the Covid-19 pandemic.

Besides, the share of hydroelectric power plants in gross electricity generation stood over 29% during the first nine months of 2020. The first unlicensed electricity generation regulation that entered into force at the end of 2010 allowed for the establishment and operation of unlicensed power plants with an upper limit of 500 kW and independently from the consumption or power of the associated generation facility.

The upper limit was increased to 1 MW in March 2013. Total installed capacity of the unlicensed power plants commissioned starting from 2016 reached 6,636.3 MW by September 2020. While SPPs accounted for most of these power plants, their contribution to total generation varied monthly.

Contributing to total gross electricity generation by 3% in 2018, unlicensed power plants increased their share in gross electricity generation to 3.5% and 4.0% in 2019 and the first nine months of 2020, respectively. The generation share of SPPs among total unlicensed power plants stood around 86% in 2019 while it rose to 97% during the first nine months of 2020.

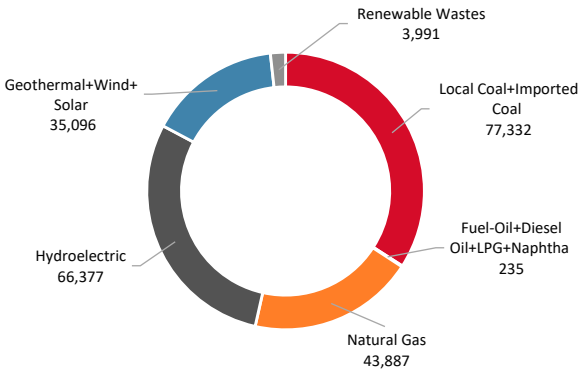
Chart 7: Generation Capacity and Actual Generation



Source: TEİAŞ, https://www.mmo.org.tr/sites/default/files/EnerjiGorunumu2018_1.pdf, TSKB

The upper limit for installed capacity at renewable power plants that are eligible to operate without a license was increased from 1 MW to 5 MW through a Presidential Resolution in May 2019. The resolution stipulates that the installed capacity be limited to the connection power in the connection agreement of the power consumption facility and that both generation and consumption take place at the same measurement point. The resolution also states that the retail single-time active power fee for the specific subscriber group announced by the EMRA will apply to the surplus electricity generated at rooftop and facade solar power plants and other renewable power plants for a period of 10 years starting from the commissioning date of the plant.

Chart 8: Gross Electricity Generation by Primary Source During the First Nine Months of 2020 (GWh)



Source: TEİAŞ, TSKB

1.1.5. Incentives

Throughout the development of the electricity sector in Turkey, incentive mechanisms were developed and introduced for both fossil fuels and renewable energy resources within the framework of the objectives of ensuring electricity supply security and increasing the electricity generated through renewable energy resources. These mechanisms include the capacity mechanism as well as YEKDEM and YEKA intended for renewable energy resources.

Pursuant to the Law on the Use of Renewable Energy Resources for Electricity Generation (YEK), YEKDEM is a feed-in tariff available for wind, solar, geothermal, biomass, wave, current and tidal power plants as well as hydropower plants with a canal or river or reservoir area of less than fifteen square kilometers. On the other hand, YEKA is a system for determining, grading, protecting and using renewable energy resource areas suitable for electricity generation in public and treasury lands and its main purpose is to support the production of domestic equipment. YEKDEM and YEKA will be explained in detail in the Renewable Energy and Energy Efficiency Section.

Capacity Mechanism

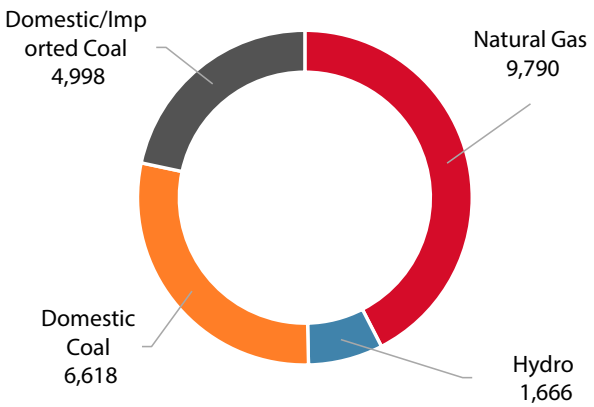
The capacity mechanism for natural gas and domestic coal-powered plants which was published in the Official Gazette of January 20, 2018 deserves attention as an incentive mechanism required for supply and system security.

Calculated in consideration of the association between the fixed and variable costs of power plants and the Market Clearing Price (MCP), this incentive is available for natural gas power plants, domestic coal-powered plants and import coal-power plants (in proportion to the ratio of the domestic coal used thereby). 28 thermal power plants with a total installed capacity of 20,912 MW benefitted from the capacity mechanism incentive amounting to TL 1,407 million in 2018.

The amendment made in November 2018 enabled the hydroelectric power plants fulfilling the conditions stipulated to benefit from the capacity mechanism. This amendment increased the total number of power plants to 43 and total installed capacity to 24,137 MW. The amount distributed via the capacity mechanism in 2019 stood at TL 2 billion.

The total amount to be distributed via the capacity mechanism in 2020 reached TL 2.2 billion. As for the power plants benefitting from the capacity mechanism in 2020, natural gas power plants have 9,790 MW, coal-powered plants have 11,616 MW and hydroelectric power plants have 1,66 MW installed power. In order to benefit from the capacity mechanism, the efficiency of natural gas power plants must be above 50%, the weighted average capacity utilization rate should not be below 10% for those based on domestic resources and 15% for others during the 12-month period retrospectively from the last date when applications are received.

Chart 9: Breakdown of Installed Capacity by Capacity Mechanism Resources in 2020 (MW)



Source: TEİAŞ, TSKB

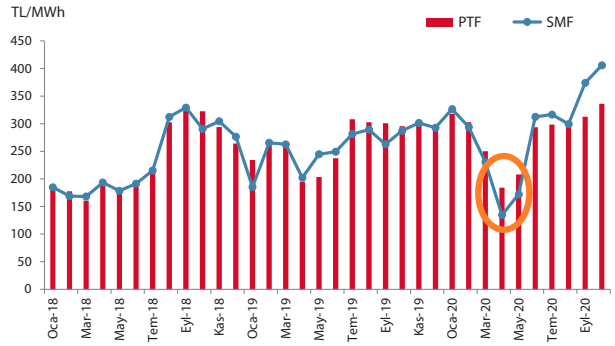
1.1.6. Price Analysis

The electricity price in Turkey is formulated for each hour over a supply curve as well as price-quantity pairs listed in ascending order and combined in a single bid. After the demand curve is formulated similarly, the intersection of supply and demand curves indicate the MCP for the hour concerned. The price in the balancing market depends on whether or not there is an energy deficit or energy surplus within the system. If there is an energy deficit in the system, the maximum hourly bid price in the system is taken as the system marginal price (SMP).

When there is a surplus, the minimum bid price accepted is taken as the SMP. Although electricity prices depend on power plant availability, climate conditions, and economic and geopolitical factors, they react instantly to any changes in commodity prices. Standing around TL 185 per megawatthour (MWh) during the first seven months of 2018, MCP rose to TL 250-300 /MWh with an increase made by Petroleum Pipeline Corporation (BOTAŞ) on the natural gas, the raw material for natural gas power plants generating electricity in August. Although weighted average MCP dropped back to TL 200 per MWh due to a rise in the electricity generated by HEPPs and a decline in electricity consumption during April and May 2019, it rose to TL 300 /MWh in average following July 2019. Considerable decreases in the demand for electricity and commodity prices due to the Covid-19 pandemic during March 2020 increased weighted average MCP to TL 250 /MWh and TL 184 /MWh in March and April, respectively. Rising to TL 208 /MWh in average during May, electricity prices surged to TL 300 /MWh in June due to the introduction of normalization steps and elevated weather temperatures.

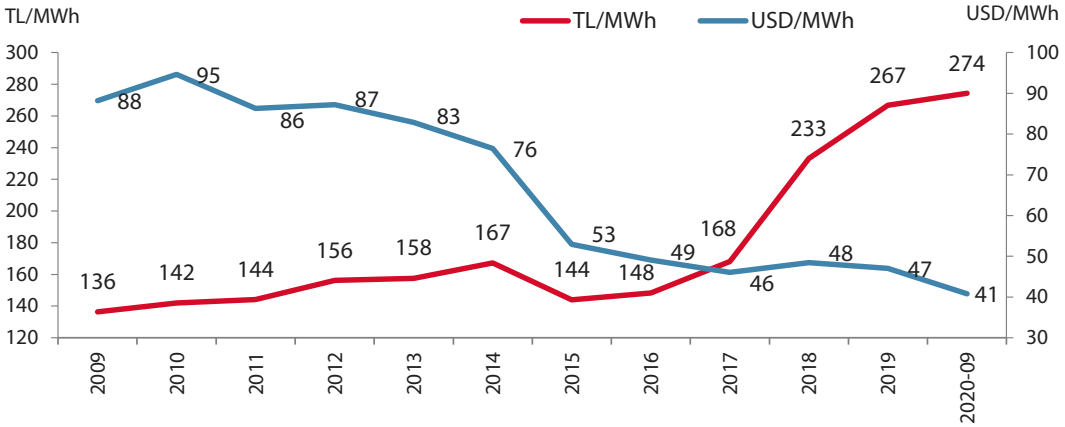
Standing around TL 136 /MWh in average by the end of the 2000s, the weighted average MCP gradually rose until 2015 and dropped to TL 144 /MWh in average in 2015. Gaining an upward trend following 2015, electricity prices made a considerable leap in 2018 to reach TL 233 /MWh in average. Standing at TL 267 /MWh in average during 2019, MCP rose to TL 274 /MWh during the ninth month of 2020. However, an analysis of the situation on the basis of USD reveals a different picture: Soaring to USD 95 per MWh in average during 2010, the weighted average MCP gradually decreased following 2010 and stood at USD 47 /MWh and USD 41 /MWh in 2019 and September 2020, respectively.

Chart 10: Monthly Weighted Average MCP/SMP



Source: EXIST, CBRT, TSKB

Chart 11: Monthly Weighted Average Growth in MCP



Source: EXIST, CBRT, TSKB

1.2. Natural Gas Outlook

Turkey's natural gas consumption grows in direct proportion with its population, industrialization and urbanization patterns and in inverse proportion with weather temperature. Turkey is a net importer of natural gas as well as oil due to limited underground wealth. Over the years, natural gas production is below 2% of consumption. Turkey's dependency on natural gas imports is over 99% with the country's gas import playing an important role in its foreign trade deficit.

While natural gas ranks the 3rd in global primary energy consumption following oil and coal, natural gas ranks the 2nd in our country's total final energy consumption following oil. In our country in line with the energy consumption estimates made on a global scale, it is expected that natural gas will be the only fossil fuel the consumption of which will increase in the short-medium term. Recent studies evaluate the integration of hydrogen into the natural gas distribution network. Hydrogen technologies are intended for reducing the carbon footprint while it is expected to decrease natural gas import. Turkey has made a huge leap in recent years in terms of natural gas distribution. Before 2001, gas distribution was possible in only 6 provinces. As of 2019, there is no province where gas distribution services are not available as it has also been distributed to Artvin, Şırnak and Hakkâri.

Standing around 1 million in 2010, the total number of subscribers for natural gas services rose to 16.3 million in July 2020 owing to the investments of natural gas distribution firms.

1.2.1. Natural Gas Reserves and Production in Turkey

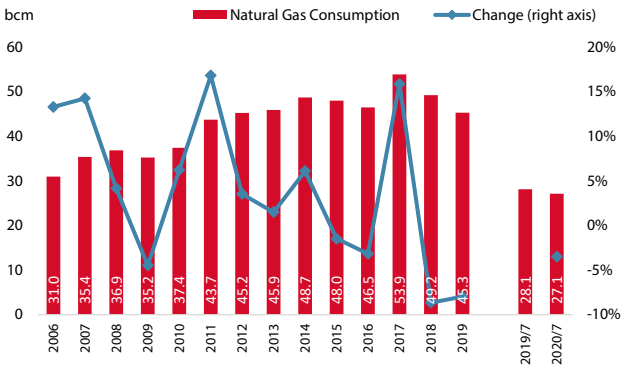
Except for announced and potential reserves in the Mediterranean and Black Sea, Turkey has a natural gas reserve of about 18.5 bcm (billion cubic meters) and a low production, thus falling short of meeting even 1% of its annual consumption. 969 bcm level achieved in 2008 could not be reached in terms of natural gas production in the following periods, and it tended to decrease after 2008, except for 2011, 2018 and 2019. In 2019, Turkey's natural gas production increased by about 11% year-on-year to 474 bcm.

According to the announcement made by President Recep Tayyip Erdoğan on August 21, 2020, Fatih drillship performing deep-sea drilling in Black Sea discovered a natural gas reserve of 320 bcm in Sakarya Gas Field (Tuna-1 Zone). It was announced on October 17, 2020 that an additional natural gas reserve of 85 bcm was discovered in Tuna-1 Zone, thus increasing the discovered natural gas reserve from 320 to 405 bcm. The activities in the well in question were completed following reaching a depth of 4,775 meters as previously planned. Recent explorations and ongoing seismic and deep-drilling activities point to a potential rise in the natural gas production of Turkey in the upcoming period.

1.2.2. Natural Gas Consumption in Turkey

Achieving the highest level in Turkey with 53.9 bcm in 2017, natural gas consumption declined in 2018 and 2019. Natural gas consumption stood at 49.2 bcm and 45.3 bcm with a drop of 8.6% and 8% in 2018 and 2019, respectively. A year-on-year comparison of the first seven months of 2020 reveals that the downward trend regarding natural gas consumption is still prevalent. It is considered that the Covid-19 pandemic, changes in the production of power plants generating electricity from natural gas and temperatures are effective in this downward trend.

Chart 12: Natural Gas Consumption and Change



Source: EMRA, TSKB

An increase in the number of households' subscribers supported natural gas consumption in 2019 while a decline of up to 40% in natural gas consumption by conversion and combined cycle sectors (power and heat plants) was the major reason for the drop-in consumption during the relevant period.

Conversion and combined cycle sectors consumed 20.5 bcm and 18.2 bcm of natural gas in 2017 and 2018, respectively while this consumption stood at 11.3 bcm in 2019. Consumption in energy sector, mainly in oil refineries, stood at 1.8 bcm while consumption in industry rose by 4% year-on-year to reach around 12.4 bcm. Household gas consumption stood at 14.4 bcm, marking a year-on-year increase of 14%. During the first seven months of 2020, when the pandemic took effect, natural gas consumption decreased by 3.5% year-on-year.

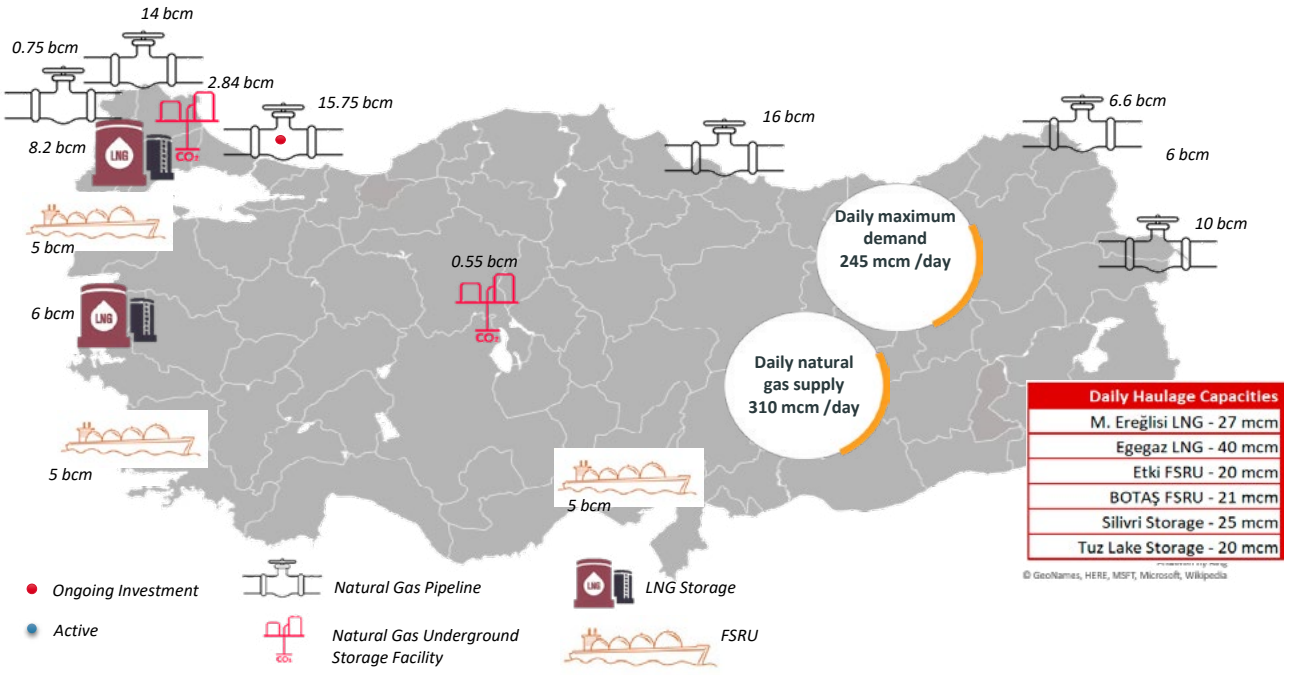
This decline was mostly attributable to demand drop in the services sector, oil refineries, chemistry sector as well as conversion and combined cycle sectors due to the pandemic while there was a rise in household natural gas consumption.

1.2.3. Natural Gas Trade in Turkey

As its domestic natural gas generation fails to meet the demand, Turkey is obliged to meet nearly all of its gas consumption via imports. In 2019, 45.2 bcm of gas was imported, marking a year-on-year decrease of 9% due to a decline in demand. During the first seven months of 2020, 25.6 bcm of gas was imported, marking a year-on-year decrease of around 14% and 4% in 2017 and 2018, respectively. Exports to Greece and Bulgaria increased by 13.3% compared to 2018 to stand at 763 mcm.

Underground storage activities play a key role in ensuring supply security. Such activities have considerably improved in recent years, attaining a storage capacity of about 3.4 bcm. In addition, there are four operational LNG terminals established for the storage, gasification and conveyance to the transmission line of liquefied natural gas (LNG). These are Marmara Ereğlisi LNG Terminal (1994-BOTAŞ), Ege Gaz A.Ş. LNG Terminal (2006-Ege Gaz), Etki Liman LNG facility (2016-Etki Liman) and BOTAŞ Dörtyol Floating Storage and Regasification Unit (FSRU) commissioned in 2017. In addition to the facilities in question, Ertuğrul Gazi FSRU ship expected to be in Turkey by the end of 2020 with a storage capacity of 170,000 m^3 of LNG (around 0.102 bcm of natural gas) has also been added into the fleet of BOTAŞ. Due to the increase in the number of FSRUs, LNG storage facilities and underground storages, a great progress has been made to ensure short-term and medium-term supply security.

Figure 2: Turkey's Natural Gas Entry-Exit Ports

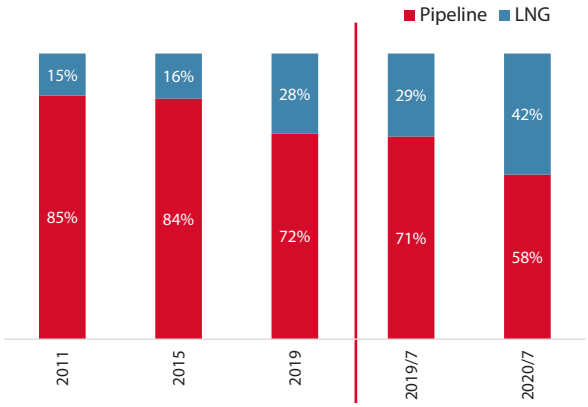


Source: EMRA, TSKB

According to the data of EMRA, the share of LNG in Turkey's gas imports has been increasing each year, reaching 12.7 bcm following an increase of about 13% in 2019. During the first seven months of 2020, the share of LNG stood 41% higher than 2018 year-on-year and surpassed the level of LNG import for the entire year of 2017. Rising to 29% in 2019, the share of LNG in Turkey's gas import is observed to have stood 40% higher during the first seven months of 2020 year-on-year. The fact that LNG imports increased in 2019 when natural gas consumption plunged similar to 2018 is a clear indication that LNG will play a key role in both global and Turkish trade in the future.

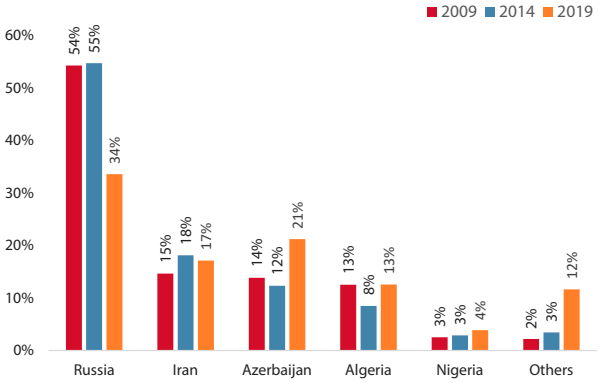
It is observed that the share of Russia in natural gas imports standing at 54% on average between 2010 and 2018 decreased after reaching 58% in 2013. The share of Russia in Turkey's natural gas imports dropped down to 34% in 2019 due to recent resource diversification activities and the completion of pipeline projects such as Trans-Anatolian Natural Gas Pipeline Project (TANAP). Turkey's total natural gas consumption decreased during 2018 and 2019, with the quantity of gas imported from Russia and Iran marking the highest drops. The shares of Azerbaijan and the countries with which LNG is traded within total supply as well as the quantities of gas supplied thereby grew.

Chart 13: Development of Pipeline Gas and LNG Share Within Turkey's Natural Gas Import (%)



Source: EMRA, TSKB

Chart 14: Change of Country Shares Within Turkey's Natural Gas Import



Source: EMRA, TSKB

Azerbaijan supplied 9.6 bcm of gas in 2019, marking the highest export to Turkey up to now. The aforementioned progress is valid also during the first seven months of 2020 and Azerbaijan's share reached the top with 23% (2019/7: 18%). During the same period, the quantity of gas imported from Russia and Iran as well as the shares of these countries within total import dropped year-on-year. Regarding LNG imports during 2019, the amount of gas purchased from Nigeria and Algeria under BOTAŞ contracts stood 20% higher year-on-year to reach 7.4 bcm. LNG spot imports grew by 4% year-on-year to stand at 5.3 bcm. About 2.5 bcm of LNG spot imports originated from Qatar.

1.2.4. Natural Gas Prices in Turkey

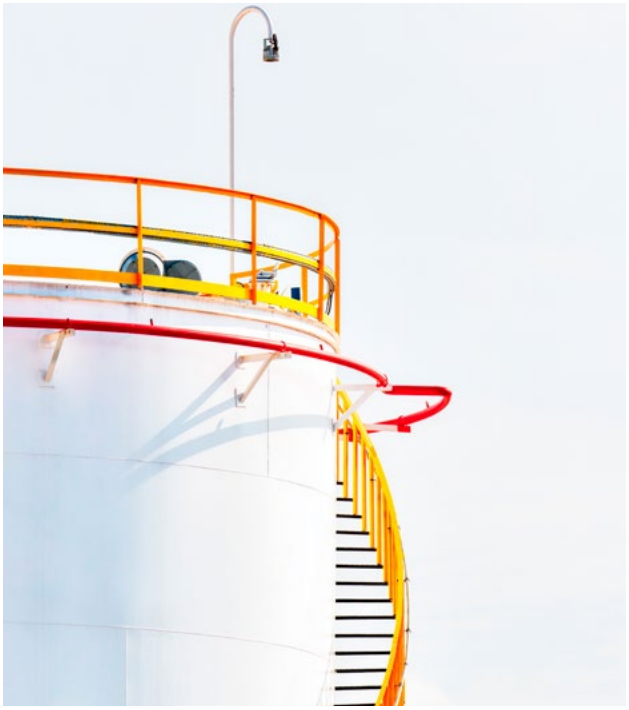
Natural gas prices in Turkey are calculated in parallel with the prices in BOTAŞ's long-term contracts and the exchange rate movements. As there was not a free natural gas market in the past, the tariffs BOTAŞ imposed on eligible consumers and distribution companies were considered as the reference price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

The global decline in gas prices since 2014, the increase in domestic competition and the price markdown after the final award favoring Turkey in the arbitration case against Iran have all rendered Turkey one of the countries offering the most convenient and advantageous retail prices in Europe.

Furthermore, TL-denominated natural gas prices have tended to increase in the second half of 2018. The subsequent period saw a more stable price development especially in the prices of natural gas intended for electricity. Natural gas prices excluding electricity generation, on the other hand, remained stable, except for the price increase in 2019.

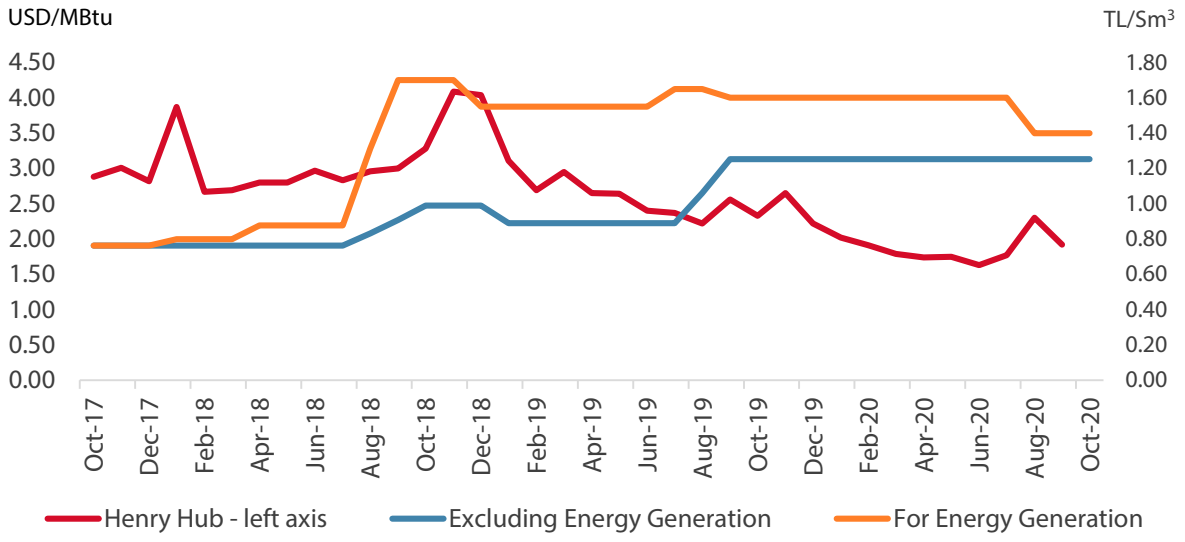
While natural gas costs did not change significantly from 2019 to the first half of 2020, the decline in MCP increased the spark spreads[1] of natural gas power plants. Low spark spread means low profitability for natural gas power plants. A markdown by BOTAŞ in July regarding natural gas tariffs to be used for power plants generating electricity from natural gas had a positive effect on the spark spread.

The portion of 52.6 bcm corresponding to 88% of the current natural gas import agreements with a total annual level of 59.9 bcm consists of long-term pipeline-based procurement agreements while the remaining portion is composed of LNG agreements. In addition to the aforementioned agreements, spot LNG imports are also in place. Turkey has strengthened its hand with regard to the natural gas procurement agreements with Russia, Algeria and Qatar, the earliest of which will expire in 2021, owing to recent infrastructure investments made for increasing supply security and resource diversity



such as TANAP and FSRU. The widespread use of LNG trade with different stakeholders especially at global level reduces the attractiveness of long-term contracts in the upcoming period. Turkey's opportunity of supplying natural gas through agreements with both lower prices and shorter durations has risen due to the investments in question.

Chart 15: Development of Natural Gas Prices



Source: EIA, CBRT, TSKB

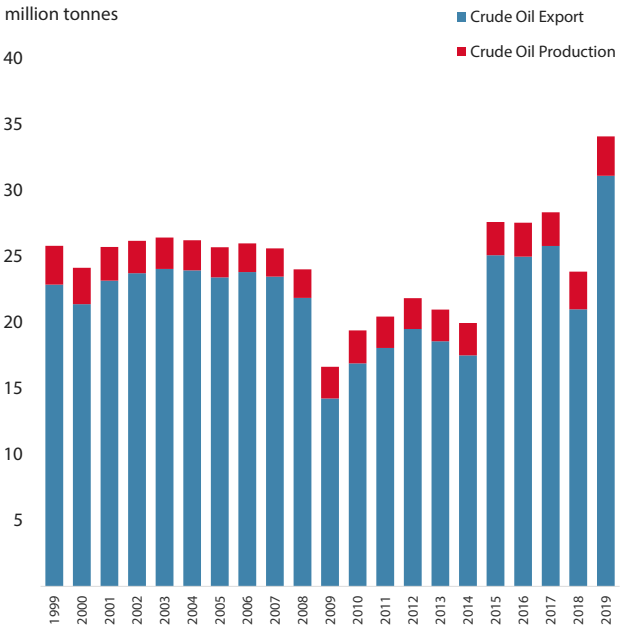
[1] Refers to the difference between the unit electricity sales prices and the unit cost of natural gas used for electricity generation

1.3. Oil Outlook

Oil has a major role in Turkey's supply of energy products as well as its final energy consumption. Petroleum and petroleum products constitute, on average, 30% of Turkey's supply of energy products and an average 35% of Turkey's energy consumption. Turkey's crude oil production has increased in years but the growth in demand has been higher, thereby resulting in a low ratio of production meeting demand.

Turkey's natural oil resources are limited and the country meets more than 90% of its need through imports. This is considered as one of the main reasons for the rise in foreign trade deficit. Oil and natural gas exploration projects have recently accelerated specifically in the Mediterranean and the Black Sea. Government officials stated that production was expected to increase in the wake of developing technologies and new exploration and discovery efforts. Oil sector activities in Turkey have gained momentum when compared to previous periods.

Chart16: Crude Oil Imports and Production



Source: General Directorate of Mining and Petroleum Affairs, TurkStat, TSKB

1.3.1. Oil Reserves, Oil Production, Refineries and Refinery Products in Turkey

In 2019, Turkey's producible oil reserves stood at 360 million barrels and are mainly located to the southeast of the country. Most oil fields in Turkey are old and well yields are falling steadily. For this reason, emerging technologies and practices intended for improving production yield are of great importance. In 2019, a total of 153 wells comprising of 80 exploratory wells and 73 production wells were drilled. 4 of these wells are co-owned by Turkish Petroleum Corporation (TPAO) while 97 thereof were drilled by TPAO and 56 by other companies operating in the sector[2].

Considering the three years preceding 2019, crude oil production stood at an average 2.5 million tons while the crude oil production amounted to nearly 2.9 million tons in 2019. In 2019, the crude oil production rose by 4.7% year-on-year to reach the highest crude oil production amount following 1999. In 2019, Turkish Petroleum Refineries Corporation (TÜPRAŞ) operated via four oil refineries located in İzmir, İzmit, Kırıkkale and Batman to process 27.2 million tonnes of crude oil, producing 28.1 million tonnes of products. 45 different products were produced in TÜPRAŞ refineries during 2019.

In order to mitigate the negative impacts of shrinkage in demand due to the Covid-19 pandemic, some facilities of TÜPRAŞ suspended their production activities, which were later gradually initiated following transition to the normalization process as of July 1, 2020. During the first six months of 2019, TÜPRAŞ produced 13.7 million tonnes of products by processing 14.3 million tonnes of crude oil. According to the data for the first six months of 2020, it processed 11.6 million tonnes of crude oil, producing 10.95 million tonnes of products through its four oil refineries located in İzmir, İzmit, Kırıkkale and Batman.

Holding a refining capacity of 10 million tonnes per year, STAR Refinery was commissioned in October 2018. Petroleum products such as diesel, high-sulfur diesel, high-sulfur fuel-oil, jet fuel, naphtha, petroleum coke, non-liquid refinery gas and LPG were produced at the refinery in 2019. Following the initiation of STAR Refinery's operations, total refinery production in 2019 increased by 39% year-on-year, reaching 34.7 million tonnes. Similarly, depending on the activities of STAR Refinery, the imports of diesel types decreased by 21%, aviation fuels by 26%, other petroleum products by 36% in 2019 while only the imports of fuel-oil types increased by 0.6%. Total export increased by 61% compared to 2018 to stand at 14.3 million tonnes[3].

1.3.2. Oil Consumption in Turkey

Following an upward trend until 2017, the consumption of oil and petroleum products decreased in 2018 and 2019, a fall extending into January-July 2020. During this period, the consumption of aviation fuels and fuel-oil types as well as total oil consumption decreased significantly due to the travel restrictions imposed in line with the measures taken especially starting from April in the wake of the Covid-19 pandemic.

[2] http://tpao.gov.tr/file/2005/2019-tpao-sektor-raporu-3185ed3b4af5442c.pdf
[3] 2019 Sector Report for Oil Market

It will be meaningful to monitor year-end consumption and stock figures to understand to what extent the demand for both crude oil and white products (gasoline, diesel, jet fuel, etc.) has been decreased by measures such as reduced intra-city mobility in 30 metropolitan cities induced by curfew restrictions, the suspension of flights, rendering inter-city bus trips conditional on permits, the restrictions imposed at border gates and the minimization of domestic and foreign freight and passenger transport services.

Table 2: Sales, Import and Export Quantities for Petroleum Products in 2019

Product Type	2019 Domestic Sales (Consumption)			2019 Total Supply	2019 Total Demand
	Refinery Sales	Distributor Fuel Sales	Distributor and Bunker Sales	(Refinery Production + Import)	(Domestic Sales + Export)
Gasoline (tonnes)	2,664	2,395,763	914	5,287,868	5,371,831
Diesel (tonnes)	-	22,109,206	425,902	24,543,534	24,656,951
Fuel-Oil (tonnes)	76,829	271,611	-	912,728	933,951
Aviation Fuels (tonnes)	151,525	-	1,024,531	6,319,094	6,232,949
Maritime Fuels (tonnes)	-	-	40,299	2,375,983	2,437,245
Total	**231,018**	**24,776,580**	**1,491,646**	**39,439,207**	**39,632,927**

Source: EMRA, TSKB

Total domestic sales of petroleum products decreased in January-July 2020 by 4.2% year-on-year to 15.6 million tonnes.

Table 3: Comparison of Domestic Sales of Petroleum Products in January-July of 2019 and 2020

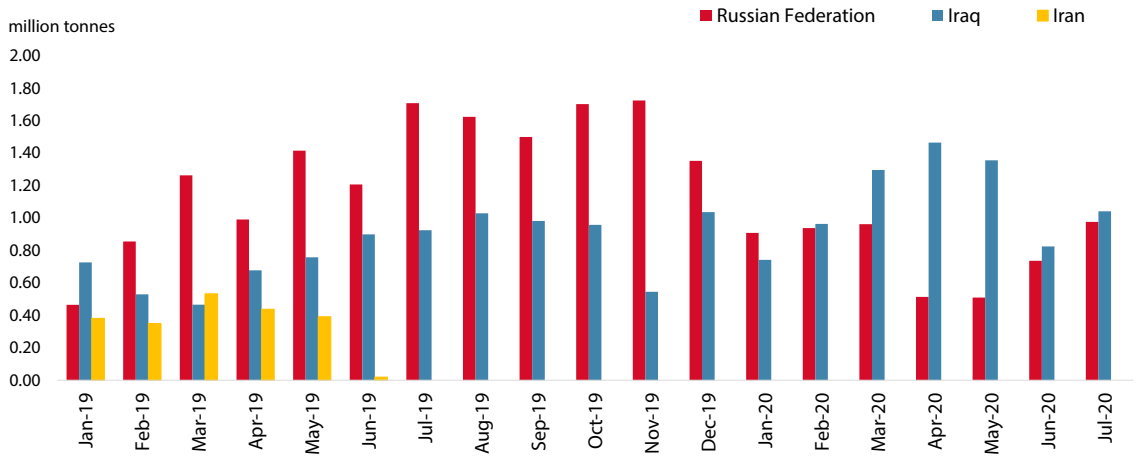
Domestic Sales (Consumption)		
Product Type	**2019 January-July Period**	**2020 January-July Period**
Gasoline (tonnes)	1,366.762	1,275,760
Diesel (tonnes)	13,739.509	13,457,012
Fuel-Oil (tonnes)	238,974	168,441
Aviation Fuels (tonnes)	699,375	400,930
Maritime Fuels (tonnes)	26,878	23,322
Naphtha (tonnes)	1,360	1,394
Other Products (tonnes)	173,892	233,572
Total	**16,246,749**	**15,560,430**

Source: EMRA, TSKB

1.3.3. Trading of Petroleum Products in Turkey

Decreasing to about 21 million tonnes in 2018 when compared to previous periods due the sanctions of USA against Iran, crude oil import surpassed 31 million tonnes in 2019 owing to a rise in the shares of Russia and Iraq in the imports of petroleum products and the commissioning of Star Refinery. No oil was imported from Iran during the last six months of 2019 and the first 8 months of 2020. No significant difference was observed regarding crude oil import during the first six months of 2020 year-on-year while the crude oil imported during July 2020 increased by 7.6% year-on-year.

Chart 17: Monthly Change of Oil Imported From Iran, Russian Federation and Iraq



Source: EMRA, TSKB

Export of petroleum products in Turkey started gradually decreasing following the second month of 2019. Standing at 1,058,359 tonnes in July 2019, the amount of export decreased by 50% to 519,968 tonnes in July 2020. It is thought that this decrease could be mainly attributed to the global Covid-19 pandemic.

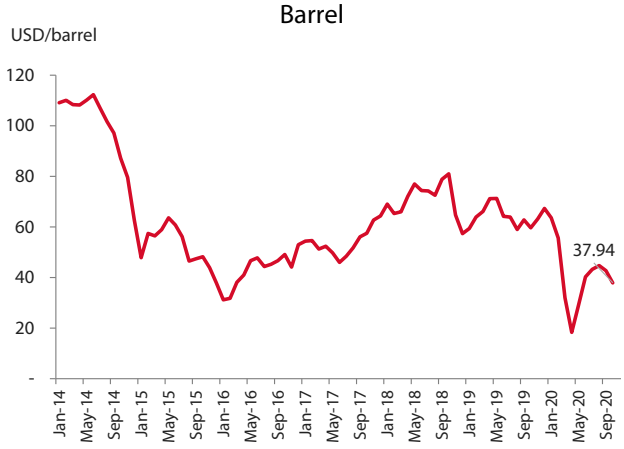
The share of TÜPRAŞ refineries and STAR Refinery within the petroleum products exported in 2019 stood at 47.2% and 9%, respectively.

1.3.4. Development of Oil Prices

Standing at USD 30 per barrel in 2016, oil prices rose to USD 50-60 per barrel in 2017. In the third quarter of 2018, the price of benchmark Brent crude oil surged to USD 80 per barrel before receding to about USD 60 per barrel in November under the impact of production increase goals by Saudi Arabia and Russia and the increase in the oil stocks of the United States of America (USA). The average price of benchmark Brent crude oil per barrel stood at USD 64 during 2019. An already low demand for oil at global level weakened further in 2020 due to reasons such as surplus supply, a rise in the value of USD, the rapidly-spreading Covid-19 pandemic and weak economic outlook and the price of Brent Crude decreased down to USD 20 per barrel. Due to the drop in oil prices, the market value of the world's 14 largest public oil companies decreased by a total of USD 495 billion in 1 week[4]. In line with these developments, oil producing countries agreed to reduce daily supply by 10%.

On the other hand, a negative price was observed in the futures contracts of West Texas Intermediate (WTI) crude oil considered as the benchmark price in the US oil markets in April 2020 in relation to the stocks and financial transactions in the US domestic market[5].

Chart 18: Development of Brent Crude Oil Prices per Barrel



Source: IEA, TSKB

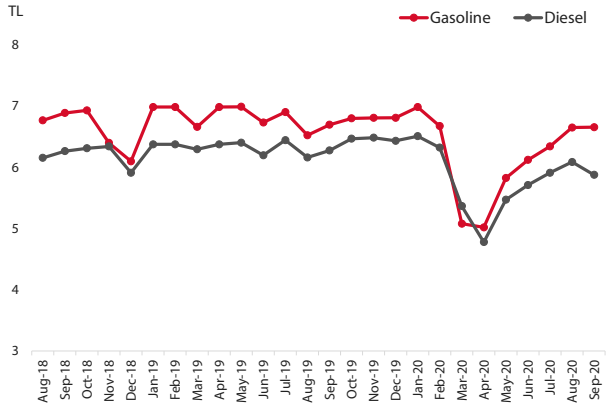
[4] Kutlu, Övünç; "Oil Giants Lost USD 495 Billion in 1 Week", Anadolu Agency, March 15, 2020.
[5] Tobben, Sheela; "Oil for Less Than Nothing? Here's How That Has Happened", Bloomberg, April 21, 2020.

This also significantly affected the shale gas produced at a high cost. The pandemic played a considerable role in the fall of oil prices. A decrease in the frequency of international flights along with travel restrictions and the partial or complete suspension of industrial and commercial activities restricted the demand for energy raw materials globally. This restriction of demand during a period of high oil supply is seen as the main reason for price decreases. However, the global economic stagnation already started taking its hold prior to the pandemic. Relatively rising following May 2020 upon these developments, the price of Brent Crude stood at USD 40-45 /barrel during January-October 2020.

Prices of petroleum products in Turkey are impacted by the changes in crude oil prices, the exchange rate volatility and taxes. Similar to the Brent Crude prices, both diesel fuel and gasoline prices followed an overall upward trend in the first half of 2019 and an overall sideways trend in the second half of 2019 on the international markets. Throughout 2019, diesel fuel and gasoline prices fluctuated in our country depending on the prices on international markets. In 2018, the average dealer sales price excluding tax was TL 3.33 per liter (lt) of 95 octane unleaded gasoline and TL 3.59 per lt of diesel fuel.

An indicative analysis of distribution for the shares of gasoline and diesel fuel within the final price including tax in the European Side of Istanbul reveals that 50% of the final price of 95 octane unleaded gasoline standing at TL 6.689/lt on average during 2019 is composed of tax and income share, 39% the product cost and 11% the gross profit margin of the companies operating in the market. It is observed that 43% of the final price for diesel products standing at TL 6.293/lt on average during 2019 is composed of tax and income share, 46% the product cost and 11% the gross profit margin of the companies operating in the market. Although the product prices for gasoline and diesel fuel are the same, the final price of gasoline is higher as the tax burden in it is higher.

Chart 19: Growth of Gasoline and Diesel Fuel Prices in Turkey



Source: EMRA, TSKB

The demand for gasoline decreased mainly due to the restriction of the mobility of gasoline-powered vehicles in parallel with the measures taken to limit the spread of Covid-19 in 2020. The partial continuation of commercial activities kept the demand for diesel fuel at a certain level, resulting in stronger diesel prices and paving the way for the gasoline prices falling below diesel prices in April. Upon a decrease in the number of cases and the relaxation of the measures, the prices started moving towards normal levels again.

1.4. Renewable Energy and Energy Efficiency

Great importance is attached to renewable energy and energy efficiency in many countries around the world for achieving sustainable development in energy as transition to a low-carbon energy system is supported through energy efficiency and renewable energy. Renewable energy and energy efficiency gain more importance every passing day for minimizing the impacts of climate change as soon as possible.

1.4.1. Renewable Energy

It is seen that the three main energy sources of the energy sector are fossil fuels, nuclear and renewable energy. Priority issues for our country include diversifying resources, increasing the domestic and renewable energy production capacities and offering affordable and sustainable energy so as to introduce a more flexible structure for the energy system.

1.4.1.1. Installed Capacity Analysis

Turkey's installed capacity in renewable energy shows an upward trend in years. Standing at 25.6 GW in 2013, Turkey's installed capacity based on renewable energy resources increased by 10% on average per year to reach around 47 GW by September 2020 while its share within total installed power standing at 40% in 2013 rose to 50.4% by September 2020. HEPPs are on the top for the rise in installed capacity based on renewable energy resources with a rise of 7.5 GW during the period between 2013 and September 2020.

HEPPs are followed by SPPs with a rise of 6.4 GW, WPPs with a rise of 5.3 GW, geothermal power plants (GPPs) with a rise of 1.2 GW and biomass power plants (BPPs) with a rise of 1 GW. While HEPPs had a share of 82% within the installed capacity of renewable energy resources in 2015, this share decreased over the years especially due to the increases in WPPs and SPPs. However, HEPPs have the largest share in the installed capacity of renewable energy sources by 63% as of September 2020. With a rapid increase in the investments for unlicensed power plants in recent years, the shares of WPPs and SPPs in the installed capacity of renewable energy sources are 17% and 14%, respectively. The share of GPPs in the installed capacity of renewable energy resources is 3% while the share of BPPs is around 3%.

Table 4: Growth of Installed Capacity for Renewable Energy (MW)

Resource	2015	2016	2017	2018	2019	2020/9
Hydroelectric	25,868	26,682	27,273	28,291	28,503	29,790
Wind	4,498	5,751	6,516	7,005	7,591	8,077
Solar	310	833	3,421	5,063	5,995	6,361
Geothermal	624	821	1,064	1,283	1,515	1,515
Biomass	345	467	575	739	1,163	1,238
Total Renewables	**31,645**	**34,554**	**38,849**	**42,381**	**44,768**	**46,981**

Source: TEİAŞ, TSKB

1.4.1.2. Electricity Generation Analysis

Standing at 261.8 GWh in 2015, total electricity generation across Turkey rose by 4% per year on average to reach 304.3 GWh in 2019 mainly due to an increase in the number of power plants based on renewable energy. In parallel with this development, electricity generation based on renewable energy sources, which was 84.2 GWh in 2015, rose to 133.7 GWh by 2019.

Table 5: Development of Renewable Electricity Generation (MWh)

Resource	2015	2016	2017	2018	2019	2020/9
Hydroelectric	67,146	67,231	58,219	59,939	88,886	66,377
Wind	11,653	15,517	17,904	19,949	21,515	18,645
Solar	194	1,043	2,889	7,800	10,542	9,624
Geothermal	3,425	4,819	6,128	7,431	8,230	6,826
Biomass	1,758	2,372	2,972	3,623	4,524	3,991
Total Renewables	**84,175**	**90,981**	**88,111**	**98,741**	**133,697**	**105,464**

Source: TEİAŞ, TSKB

Standing at 31.8% in average between 2015 and 2018, the share of renewable energy resources within total generation rose to 43.9% and 46.5% during 2019 and the first 9 months of 2020 as a result of a rise in generation observed in all renewable energy power plants and a drop-in generation by natural gas power plants. HEPPs had a share of 80% within renewable energy-based electricity generation in 2015 while there was a decline in this share over years.

Imported and domestic coal-powered plants achieving a share of 34% within total gross electricity generation during the first 9 months of 2020 are followed by HEPPs with a share of 29%, natural gas power plants with a share of 19%, WPPs with a share of 8%, SPPs with a share of 4%, GPPs with a share of 3% and BPPs with a share of 2%.

Turkey has significant resources in terms of wind, geothermal and solar power. Developing these resources is of vital importance in terms of both combating the climate change and reducing import and fossil fuel dependency in energy.

According to the report prepared by the International Energy Agency (IEA) in July 2020 in cooperation with the International Monetary Fund (IMF), it is expected that the global energy demand will drop by 6% in 2020 year-on-year due to the Covid-19 pandemic but the electricity generated based on renewable resources will rise by 5%[6].

1.4.1.3. Renewable Energy Resources Support Mechanism

Pursuant to the Law No. 5346 on the Use of Renewable Energy Resources for Electricity Generation (YEK Law), wind, solar, geothermal, biomass, wave, current and tidal power plants as well as hydropower plants with a canal or river or reservoir area of less than fifteen square kilometers can benefit YEKDEM for 10 years. Power plants commissioned or to be commissioned from May 18, 2005, the effective date for YEK Law, until December 31, 2020 will be covered by YEKDEM.

YEKDEM unit prices are USD 73 /MWh for hydropower and wind power plants, USD 105 /MWh for geothermal power plants and USD 133 /MWh for biomass and solar power plants. Furthermore, in line with the provisions in the regulation on the use of domestic-made parts and components at power plants, the above-stated prices may be added with the unit prices included in the Table in Annex-II of YEK Law for a period of five years according to the extent of domestic-made parts used.

Table 6: Feed-in Tariffs Under YEKDEM and Incentives for Domestic Components

Facility Type	Guaranteed Price (USDcent/kWh)	Incentives for Domestic Components (USDcent/kWh)
HEPP	7.3	1.0—2.3
WPP	7.3	0.6—3.7
GPP	10.5	0.7—2.7
BPP	13.3	0,.4—5.6
SPP	13.3	0.5—6.7

Source: EMRA, TSKB

It is stated by the Ministry officials that they are working on a support mechanism encompassing new conditions for the power plants to be commissioned after December 31, 2020. It is also stated that this prospective support mechanism will be TL-denominated and priced based on an escalation system but no official statement has been issued yet. In addition, as per the Presidential Resolution published in the Official Gazette on September 18, 2020, the condition for the commissioning of the generation plants eligible for YEKDEM by December 31, 2020 was extended to June 30, 2021[7]. According to the resolution, the price support eligible for the YEK-certified generation plants subject to YEKDEM to be commissioned from January 1, 2021 to June 30, 2021 will apply until December 31, 2030.

Due to the aforementioned feed-in tariffs and the increase in foreign exchange rates, the number of renewable energy power plants that wish to benefit from the USD-based feed-in tariffs under YEKDEM has increased. As specified in the Electricity Outlook Section, the number of power plants to benefit from YEKDEM in 2020 rose to 817, and the total installed capacity increased to 21,860 MW. In addition to licensed power plants, unlicensed power plants with a total installed capacity of approximately 6,600 MW also benefit from YEKDEM.

[6] IEA, World Energy Outlook 2020, Sustainable Recovery Report, July 2020 (in collaboration with IMF).
[7] Official Gazette, https://www.resmigazete.gov.tr/eskiler/2020/09/20200918-8.pdf

Table 7: Development of Final YEK List (MW)

Resource	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hydroelectric	21	930	217	598	2,218	9,561	11,096	11,706	12,588	12,446
Wind	469	685	76	825	2,775	4,320	5,239	6,200	6,496	6,974
Biomass	45	73	101	147	193	204	300	349	503	762
Geothermal	72	72	140	228	390	599	752	997	1,253	1,503
Solar	-	-	-	-	-	-	13	14	82	175
Total	**607**	**1,760**	**534**	**1,798**	**5,575**	**14,684**	**17,400**	**19,266**	**20,921**	**21,860**

Kaynak: EMRA, TSKB

1.4.1.4. Renewable Energy Resource Area (YEKA)

YEKA projects in Turkey support the country's strategy for supply security, domestic and renewable energy resources, but also are of great importance in terms of sustainable energy objectives. Tenders help attract foreign investors. On the other hand, the production of domestic energy equipment and incentives intended for R&D centers are also considered positive in terms of creating added value for the country's economy, reducing the current account deficit and creating employment opportunities.

MENR developed YEKA model in 2016 for large-scale investments. The first YEKA tender was organized for Karapınar SPP in 2017, and Kalyon and its South Korean partner Hanwha were awarded with the tender. However, Hanwha decided to withdraw from the joint venture in January 2019 due to financial issues. In October 2019, Kalyon Energy and China Electronics Technology Group Corporation (CETC) closed a deal for a 500-MW solar panel factory, which was commissioned in August 2020. In September 2020, 4 MW of the 1,000-MW SPP was commissioned and the SPP started generating electricity. The first 1,000-MW WPP YEKA tender held in 2017 was awarded to Siemens-Türkerler-Kalyon joint venture over a bid of 3.48 USD cents per kilowatthour (kWh). Siemens Gamesa Renewable Energy company started manufacturing nacelles in the newly-established company at the end of November 2019.

Table 8: Completed YEKA Tenders

	YEKA SPP-1	YEKA WPP-1	YEKA WPP-2
Location	Konya Karapınar	Edirne, Kırklareli, Sivas, Eskişehir	Aydın, Balıkesir, Çanakkale, Muğla
Date	3/20/2017	8/3/2017	5/30/2019
Capacity (MW)	1	1	1
Winning Price	69.9 USD/MWh	34.8 USD/MWh	35.3-45.6 USD/MWh
Sponsor Firm	Kalyon, CETC	Kalyon, Siemens Gamesa, Türkerler	Enerjisa (Aydın, Çanakkale) Enercon (Balıkesir, Muğla)
Purchase Warranty Period	15 years	15 years	15 years
Domestic Equipment Rate	60% for first 500MW, 70% for second 500MW	60%	55%

Source: EMRA, TSKB

It was announced in 2018 that January 2019 would be the deadline for applications regarding Turkey's second largest solar power plant tender. This tender incorporated three separate contests, one for an installed capacity of 500 MW in Viranşehir, Şanlıurfa, one for 200 MW in Erzin, Hatay and one for 300 MW in Bor, Niğde. However, it was announced in January 2019 that the tender was cancelled. YEKA tenders continued in 2018 as well. On June 21, 2018, a tender for a 1,200-MW offshore wind farm project was announced but this tender was postponed since the tender failed to attract a sufficient demand.

YEKA WPP-2 tender was held on May 30, 2019. The tenders covered WPPs with an installed capacity of 250 MW in Balıkesir, Çanakkale, Aydın and Muğla. Enercon and EnerjiSA were each awarded two of these tenders. Enercon's bid of 4.00 USD cents /kWh enabled the company to win the Muğla tender while a bid of 3.53 USD cents /kWh secured the Balıkesir tender. EnerjiSA, on the other hand, was awarded the Aydın tender with a bid of 4.56 USD cents /kWh and the Çanakkale tender with a bid of 3.67 USD cents /kWh.

The applications for 74 YEKA tenders, also known as Mini YEKA and targeting a total installed capacity of 1,000 MW, were postponed from October 5-9, 2020 to January 18-21, 2021. In addition, pre-license applications for 2,000-MW wind power plants to be received on October 5-9, 2020 were also postponed.

Table 9: Cancelled, Postponed, Pending YEKA Tenders

	YEKA SPP-2 (Cancelled)	YEKA Off-Shore WPP-3 (Postponed)	Mini YEKA SPP-3 (Application will be received)*
Location	Niğde, Hatay, Şanlıurfa	Gelibolu, Saroz, Kıyıköy	36 region (74 YEKA tender)
Capacity (MW)	1	1.2	1
Ceiling Price	65 USD/MWh	80 USD/MWh	300 TL/MWh
Purchase Guarantee Period	15 years	-	15 years
Purchase Guarantee Amount	-	50 TWh	-
Domestic Equipment Rate	60%	60%	60%

*Applications will be accepted on 18-21 January 2021.

Source: EMRA, TSKB

Increasing the share of electricity generated based on renewable energy resources is of great importance for transition to a low carbon economy. However, it is absolutely necessary to make good use of the potential of energy efficiency, now considered a supply resource, and benefit from the opportunities offered thereby.

1.4.2. Energy Efficiency

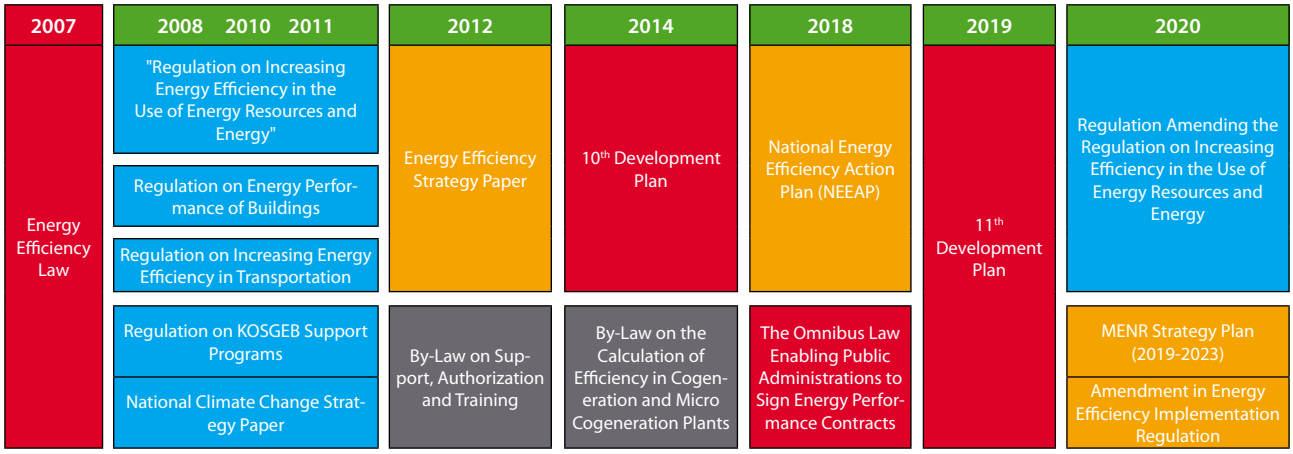
Energy efficiency is a concept referring to the utilization of energy resources at all stages from generation to consumption with maximum efficiency. In this sense, energy efficiency means preventing energy losses that may materialize in many different forms such as heat, gas, steam, pressurized air and electricity as well as the reduction of energy consumption through the use of new and innovative technologies without affecting production, service provision, comfort standards and social welfare.

Thus, energy efficiency is a horizontal area that complements other national objectives in the energy sector and supports transition to a low-carbon economy and is one of the most important pillars of efforts to render development sustainable.

1.4.2.1. Energy Efficiency Legislation and Organizational Infrastructure

Activities intended for the measures required for energy efficiency were initiated especially during the 2000s. The "Energy Efficiency Law" No. 5627, which entered into force in 2007, aims to alleviate the burden of energy costs on the economy and improve efficiency in the use of energy to protect the environment. Published in 2012, the "Energy Efficiency Strategy Paper" sets energy efficiency objectives for 2023.

Figure 3: Energy Efficiency Policy Documents and Legislation



Source: TSKB

In line with emerging needs and in order to improve the 2012 strategy further, the "National Energy Efficiency Action Plan (NEEAP)" was prepared in 2017, considering the best practices across the globe. Covering 55 actions to be implemented between 2017 and 2023 under the categories of buildings and services, energy, transport, industry and technology, agriculture and horizontal matters, the NEEAP aims to reduce primary energy consumption by 14% by 2023 (savings of 23.9 million tonnes of oil equivalent (MTOE)). An investment of USD 10.9 billion is envisaged for achieving such savings.

Table 10: Required Investment Amount and Targeted Energy Savings

Required Investment Amount ('000 USD)							
2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
958	1,279	1,593	1,681	1,748	1,824	1,846	10,929

Energy Savings															
2017		**2018**		**2019**		**2020**		**2021**		**2022**		**2023**		**Cumulative**	
kTEP	'000 USD	kTEP	'000 USD	kTEP	'000 USD	kTEP	'000 USD	kTEP	'000 USD	kTEP	'000 USD	kTEP	'000 USD	kTEP	'000 USD
577	202	1,630	571	2,493	872	3,378	1,182	4,298	1,504	5,264	1,842	6,261	2,191	23,901	8,364

Source: MENR NEEAP, TSKB

The MENR stated that energy savings of 2.74 MTOE corresponding to USD 960 million in monetary terms were cumulatively achieved during 2017-2019 within the framework of the actions under the NEEAP. It was announced that a total of USD 1.18 billion was invested for energy efficiency in 2019 and, as a result, primary energy savings of 858,000 TOE corresponding to USD 300 million in monetary terms were achieved[8]. Considering the level of improvements achieved during 2017-2019 as well as the overall problems experienced in economy in 2020, it is understood that it will not be easy to reach the targets within the NEEAP for 2023.

[8] MENR, National Energy Efficiency Action Plan 2019 Development Report, Executive Summary. Available at: https://enerjiapi.etkb.gov.tr//Media/Dizin/EVCED/Raporlar/Ulusal%20Enerji%20Verimlili%C4%9Fi%20Eylem%20Plan%C4%B1/UEVEP%202019%20Geli%C5 % 9Fim 20% Report% 20Y% C3% B6netici 20% C3% 96zeti.pdf

However, it is important to monitor the targets set and share the findings with the public in a transparent manner in order to demonstrate the determination on this issue.

The Eleventh Development Plan published in July 2019 aims to ensure uninterrupted, high-quality, sustainable, reliable and affordable energy supply. Objectives regarding energy efficiency within the Eleventh Development Plan are given below:

1. Rehabilitation of the publicly-operated power plants will be completed.

2. Development Agency subsidies will be restructured and priority will be given to issues such as institutionalization, innovation management, customer relationship management, corporate resource planning, e-trade, digital transformation, foreign trade, lean manufacturing, clean production, energy efficiency, and industrial symbiosis.

3. Energy efficiency will be improved in the manufacturing industry.
a. Subsidy mechanism will be established for the replacement of inefficient electric motors used in industry with efficient ones.
b. It is ensured that cogeneration systems will be expanded in large industrial plants using heat.
c. To promote and disseminate exemplary energy efficiency practices, energy efficiency projects will be supported by competitions and it is ensured that legislation and technical infrastructure will be established concerned with the implementation.
d. Heat market legislation will be established to expand energy-efficient district heating and cooling systems throughout the country and to enable heat trade.
e. Projects with high savings potential will be supported by improving efficiency-boosting project implementation processes.
f. Support will be provided for OIZs, to prepare and present Productivity Action Plans by completing their Energy Management Unit and ISO 50001 Energy Management System establishment.

4. Domestic production in the sector will be improved through activities aiming at promoting energy efficiency in the electrical equipment and domestic appliances sector.
a. The replacement of energy-inefficient motors used in industrial plants with more efficient motors will be supported.
b. Awareness on efficiency improvement potential will be raised by applying energy labels on the electrical motors used in industrial plants.

5. With regard to technical textiles, which is one of the key areas in the transformation of high value-added structure in the textile-clothing and leather industry, companies will be supported to select optimum technology, comply with the environmental protection legislation, energy efficiency and waste re-use activities and cooperate with other stakeholders in the value chain (in particular machinery, fiber and technical end-use manufacturers).

6. Measures to reduce carbon emissions will be developed through additional measures such as energy efficiency gains and increasing forest assets.

7. For expanding the buildings that are more efficient and produce their own energy, energy efficiency in existing buildings will be promoted through support systems.

8. Green Port practices will be supported to boost energy efficiency in port operations, minimize environmental impacts and ensure sustainability.

9. Quality, safeness, accessibility, energy efficiency and disaster resilience standards will be developed in housing production and will be taken into consideration at every level.

"The Regulation Amending the Regulation on Improving Efficiency in the Use of Energy Resources and Energy" of January 25, 2020 stipulates that the number of consumers subject to energy efficiency audits must be increased, the audit processes must be facilitated, the facilities obliged to appoint an energy manager or establish an energy management unit must establish ISO 50001 Energy Management System while measurement-verification specialists were also defined in the legislation.

In May 2020, the Strategic Plan covering the years 2019-2023 was published by the MENR. This strategic plan aims to sustain activities intended for supporting energy efficiency, create a market infrastructure for demand-side engagement for electricity and natural gas, engage in activities to raise public awareness on energy efficiency and plan the energy system for electric vehicles so as to prioritize energy efficiency and increase the number of practices in this vein.

1.4.2.2. Energy Efficiency Indicators

Various benchmarking methods and indicators are employed in defining the energy efficiency positions of countries, sectors and firms against each other. The main energy efficiency indicators used include energy intensity calculated as the proportion of energy consumption to GDP (TOE/'000 USD), energy consumption, regression analysis, and energy efficiency index (ODEX). In measuring energy efficiency in buildings, various energy efficiency indicators such as energy consumption per household and energy consumption per each square meter of the household (kWh/m^2) can be employed. In transport, the indicators used include energy consumption per ton/km (freight transport), energy consumption per person/km (passenger transport) and energy consumption per vehicle (miles/gallon or lt/100 km).

Although each benchmarking method has its own technical issues, the scales addressed by each indicator vary. For instance, energy intensity is the most efficient indicator in benchmarking among countries owing to its macro aspect. However, specific energy consumption provides more significant results when benchmarking within sectors. Furthermore, CUSUM and regression analysis are the most convenient methods for internal benchmarking at a company level.

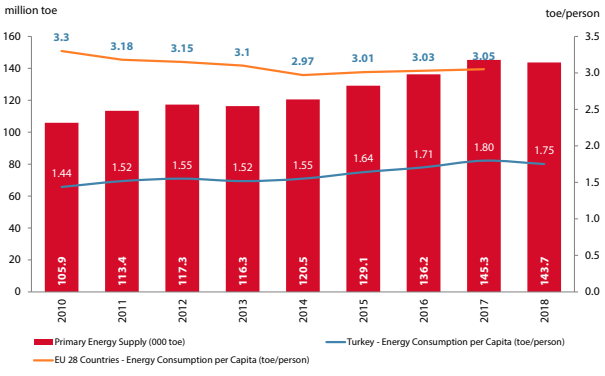
1.4.2.2.1. Energy Intensity and Per Capita Energy Consumption

Energy intensity is an energy efficiency indicator that measures how much energy is required to generate a unit of GDP on the basis of regions and countries. The ideal scenario in calculating energy intensity occurs when the GDP rises but energy consumption remains low. In other words, a low energy intensity ratio (TOE/GDP) positively singles out a country in assessing energy efficiency.

It is observed that energy intensity does not decrease in Turkey due to the slowdown in GDP growth during 2010-2018, the volatility in the indicative foreign exchange rate and the failure to launch energy efficiency policies at the desired level. Energy intensity in the world was improved by 1.7% and 1.2% in 2017 and 2018, respectively. However, the improvement in 2018 was observed as the lowest energy efficiency improvement rate since 2010. Considering the importance and priority of energy in daily life, per capita energy consumption may be regarded as an indicator for the development and welfare level of a country to a certain extent.

A high energy consumption per capita is usually the indicator of a high welfare level in the relevant country. However, while comparing per capita energy consumption among countries, certain parameters of the respective countries such as its demographic structure, geographical location and climate should be considered.

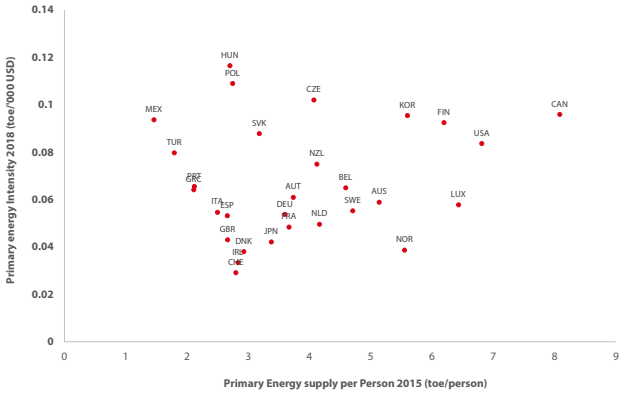
Chart 20: Development of Per Capita Primary Energy Consumption in Turkey



Source: MENR, TSKB

For instance, per capita energy consumption may rise in a country as the population decreases. This is a misleading situation called the base load effect.

Chart 21: Energy Intensity and Primary Energy Supply in Some Selected Countries (2018)



Source: World Bank, TSKB

On the other hand, reasons increasing energy consumption include heating in cold regions, cooling in hot regions and the need for long-distance transport and logistics in countries with a huge area. These each have an impact on per capita energy consumption.

Despite an increasing population, Turkey's per capita primary energy consumption has increased as well by years. It is observed that per capita consumption decreased in 2018 due to the economic stagnation. Turkey's per capita energy consumption (1.75 TOE) is still behind that of many developed countries. Considering the 2018 data, per capita electricity consumption in Turkey is low when compared to other countries. However, Turkey's level is medium-high in terms of energy intensity or, in other words, energy consumption per GDP.

1.4.2.2.2. Sectoral Energy Intensity

The sectors that stand out the most in energy efficiency studies are industry-manufacturing, transport, housing and energy generation-distribution systems. An analysis of Turkey's energy intensity from a sectoral perspective shows that the energy intensity in the industry-manufacturing industry is far beyond those in transport, services and agriculture sectors. Industry and buildings are the areas that offer the greatest opportunity in terms of energy efficiency. Although there are differences in potential energy efficiency gains among sub-sectors, high energy consumption in the industry makes this sector a target sector for incentivizing energy efficiency investments. Noteworthy developments are present in Turkey due to the projects and supports executed in the country. It is possible to assume that the improvements in the manufacturing industry mostly arise from process and equipment renewals. Manufacturing through modern technologies including electric motors and other equipment has become much more efficient than before.

The building sector offers a great potential for achieving high efficiency gains because no considerable improvement investment has been made in the old buildings within Turkey up to now. More importantly, the conditions to which new buildings are subject are not as stringent as those applicable in countries with similar degree-day conditions in Europe. In buildings, restorations and repairs make a definite impact on efficiency improvements. Similarly, new electrical devices consuming less energy have played a considerable role in energy savings achieved in buildings up to now. It is expected that global energy efficiency investments intended for houses will decrease by 15% (corresponding to about USD 150 billion) in 2020 due to the Covid-19 pandemic[9]. In Turkey, it is possible to argue that a similar standstill is present in this area. However, the programs initiated especially for public buildings aim to play a driving role and constitute a guiding framework.

[9] WEO Outlook 2020, Sustainable Recovery Report, July 2020, IEA (in collaboration with the International Monetary Fund (IMF))

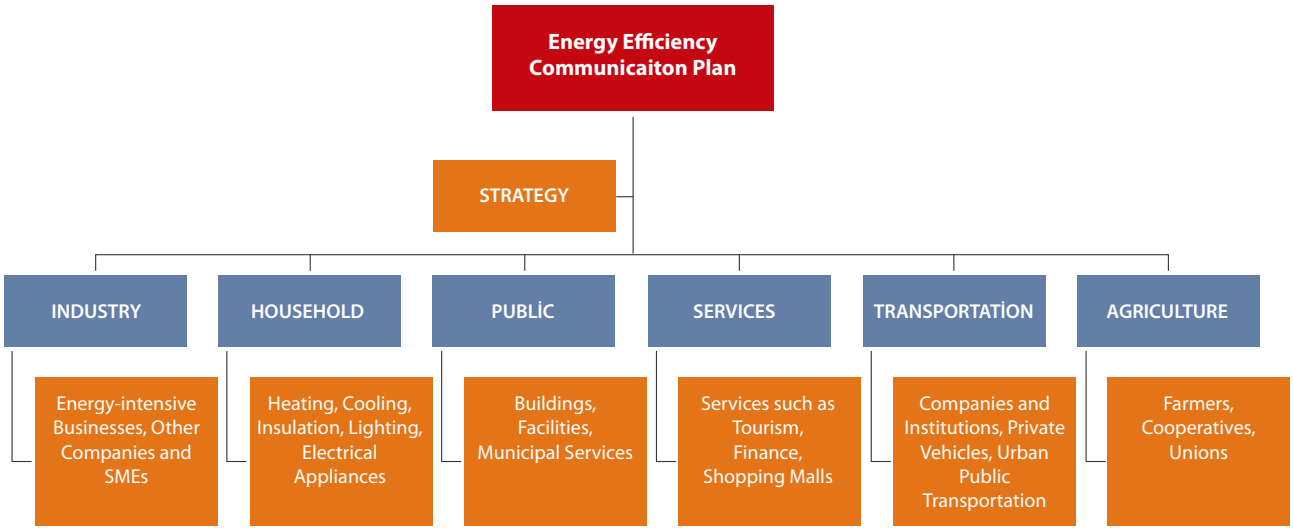
1.4.2.2.3. Energy Efficiency Monitoring and Awareness Activities

Energy efficiency activities in Turkey are conducted by the MENR. However, the Ministry of Industry and Technology (MoIT) bears additional responsibilities regarding energy efficiency for some areas such as electricity-consuming devices and the Ministry of Environment and Urbanization (MoEU) regarding the environment. The Energy Efficiency and Environment Department (EEED) was established in January 2019 to engage in energy efficiency, sustainability and climate change actions. EEED carries out various activities in order to create an energy efficiency culture in the society, to raise awareness on efficiency and environmental issues and to change consumption habits in a positive way.

It examines whether the liabilities regarding the provisions of the relevant legislation are fulfilled and extends Efficiency-Boosting Project (EBP) Supports, Voluntary Agreement Supports and various regional incentives. Energy efficiency audit studies identify baseline and savings potential in final energy consumption sectors such as industry and building, aiming to render energy managers competent about energy efficiency. Besides, international collaborations and projects are developed (The Third Country Training Program in cooperation with JICA and TİKA, Turkey-Denmark Strategic Sectoral Cooperation Efficient and Low-Carbon Heating and Cooling Project, Turkish-German Energy Forum Energy Efficiency Working Group, Project on the Preparation of a National Energy Efficiency Financing Mechanism Roadmap and the Establishment of a Competitive Energy Efficiency Tender Mechanism in Turkey, IPA Technical Assistance for Institutional Capacity Building in Energy Efficiency, IPA 2015 Project for the Procurement of Equipment for Municipalities, European Energy Network Membership and Cooperation, etc.).

Published in May 2020 for revealing the awareness level of Turkey on energy efficiency, the Energy Efficiency Index Survey shows that the awareness level of households on energy efficiency is in the range of 0-200 (157.7) or, in other words, households have a medium-high level of awareness. Pointing to a score of 177.9 or, in other words, high-low level in terms of knowledge, the index corresponds to 137.5 in terms of behaviors referring to medium-low level.

Figure 4: Energy Efficiency Communication Plan



Source: MENR

In line with these findings, "Energy Efficiency Communication Plan" was drawn up in June 2020 for planning the communication activities envisaged for achieving the energy efficiency goals and objectives of Turkey. Stakeholders of the "Strategic Communication Plan" published by the MENR include industry, transport, agriculture and services sectors, households and public institutions.

Besides, the National Energy Efficiency Action Plan Monitoring and Steering Board was established on December 7, 2019 to actively execute the energy efficiency activities requiring that public authorities, the private sector and civil society organizations act via a participatory approach and in cooperation with the participation of all responsible and relevant institutions and organizations across the country, develop energy efficiency strategies at national level, prepare action plans and programs, ensure coordination for monitoring the levels of realization including for the National Energy Efficiency Action Plan and actively implementing it, monitoring its outcomes, change and update it where necessary.

Table 11: Energy Efficiency SWOT Analysis

STRENGTHS	WEAKNESSES
A rise in the awareness of the society on energy efficiency	The need for sectoral capacity building
Presence of legislation/technical/administrative infrastructure and practices	Difficulty in access to financing
The fact that actions and objectives have been set and practices are followed within the framework of the National Energy Efficiency Action Plan	The need for insurance/collateral and risk management improvements regarding the feasibility of energy efficiency projects
	The fact that energy efficiency investments are not prioritized
	Lack of awareness in some industries
	The need for improving the measurement, monitoring and verification infrastructure
OPPORTUNITIES	**THREATS**
Availability of international finance opportunities	The fact that energy efficiency is a multi-disciplinary field and requires the coordination of more than one institution and organization; delays in the development of necessary mechanisms
Direct impact of energy efficiency on increasing supply security, reducing the current account deficit and reducing greenhouse gas emissions in the fight against climate change	The fact that energy efficiency projects are not preferred by consumers due to an overall long payback period
A rise in the priority of "energy efficiency" concept in the world and our country	Global and national economic stagnation
The fact that cost-cutting activities gain more importance in the face of increasing national and international competition	Lack of information and lack of interest regarding the development processes of energy efficiency projects
Presence of untapped high energy efficiency potential in almost every sector	Trend of increased consumption in case of a decline in costs

Source: MENR

In addition, the motto "Live Efficiently with Your Mind" was accepted as the slogan within the campaign developed in line with the Energy Efficiency Awareness Plan. It is envisaged that activities regarding energy efficiency will be carried out in important days and weeks especially including but not limited to the Energy Savings Week celebrated in the second week of January and the World Savings Day on October 31st.

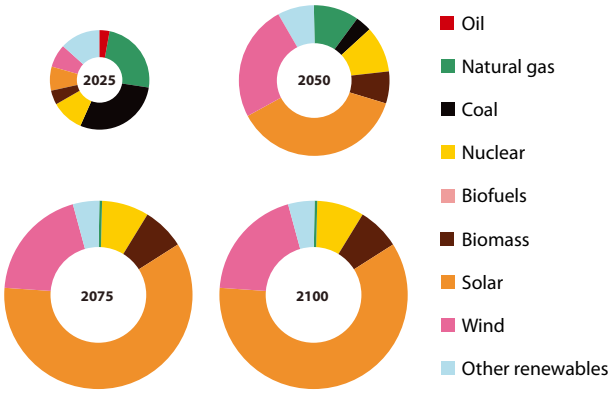
1.5. Energy Market Trends and Expectations

Importance attached to supply security and energy efficiency draws attention due to the renewable energy technologies becoming more affordable, digital applications and a rise in the role of electricity. It is possible to categorize the general trends in the energy market in recent years under four main groups and these trends are briefly analyzed under the following sub-headings.

1.5.1. Solar and Wind Power Becoming Dominant in Electricity Generation

With new prospective investments intended for electricity grid connection and integration, renewable energy is expected to take a 62% share in total electricity generation by 2050. In Chart 22, the circle represents the total electrical energy demand while the slices represent the ratios of different energy sources and the level to be attained by solar energy through its great potential until 2025, 2050, 2075 and 2100 is shown in a striking way.

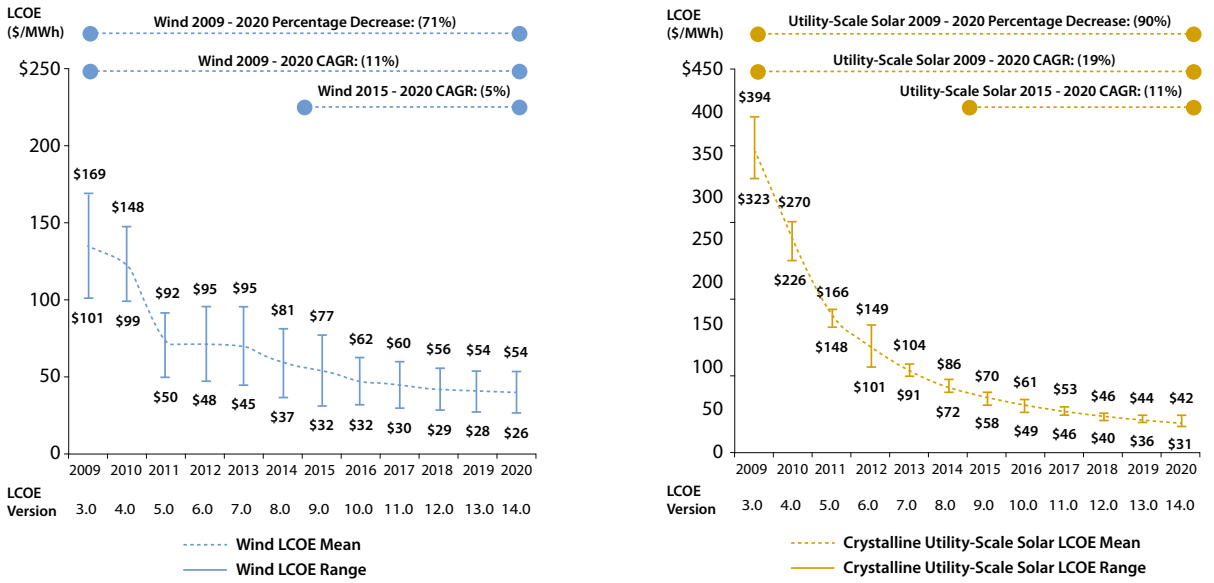
Chart 22: Electricity Demand and the Shares of Different Resources in the Near and Far Future



Source: Shell Scenarios Sky, "Meeting the Goals of the Paris Agreement", 2020[11]

[10] US Energy Information Administration (EIA), International Energy Outlook (2019)
[11] Shell Scenarios Sky, https://www.shell.com/promos/business-customers-promos/download-latest-scenario-sky/_jcr_content.stream/1530643931055/eca19f7fc0d20adbe830d3b0b27bcc9ef72198f5/shell-scenario-sky.pdf

Chart 23: LCOE Growth of Wind and Solar Power Plants

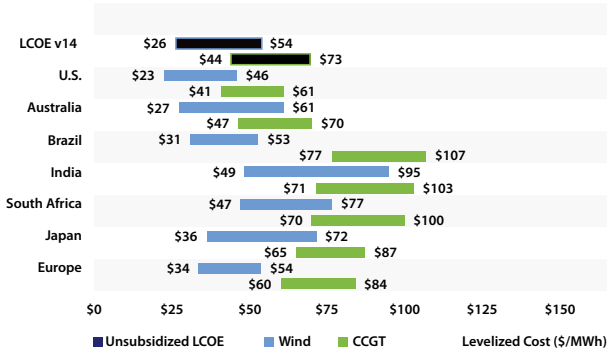


Source: Lazard, LCOE Analysis (2020)[12]

The share of renewable energy, especially the electricity generated from wind and solar power plants within the total energy supply is gradually increasing. Main underlying factors are as following: the power plants in question are environmentally-friendly, there is a downward trend in generation costs and the compliance of such power plants with the electricity grid rises due to emerging technologies.

As solar and wind power plants become more common, the levelized cost of energy (LCOE) of these technologies is decreasing. As seen in Chart 23, the LCOE of wind power plants reached USD 26-54 /MWh and the LCOE of solar power plants reached USD 31-42 /MWh in 2020. To compare the downward trend below, the LCOE of natural gas, the cheapest fossil fuel resource, remains in the range of USD 44-73 /MWh as seen in Chart 24.

Chart 24: LCOE Comparison of Wind and Natural Gas-Powered Plants for Different Countries



Source: Lazard, LCOE Analysis (2020)

1.5.2. Distributed Energy Grids Replacing Traditional Central Networks

In a not so distant future, traditional central electricity grid infrastructures will be replaced by distributed energy networks, so the final consumption points and electricity generation plants will converge geographically and in number, and losses in the transmission and distribution of energy will be reduced. The availability of electricity grids will increase and unplanned downtime due to malfunctions will decrease, lower energy density will be achieved in electricity generation and opportunities for the integration of renewable energy sources into the electricity grid will be on the rise.

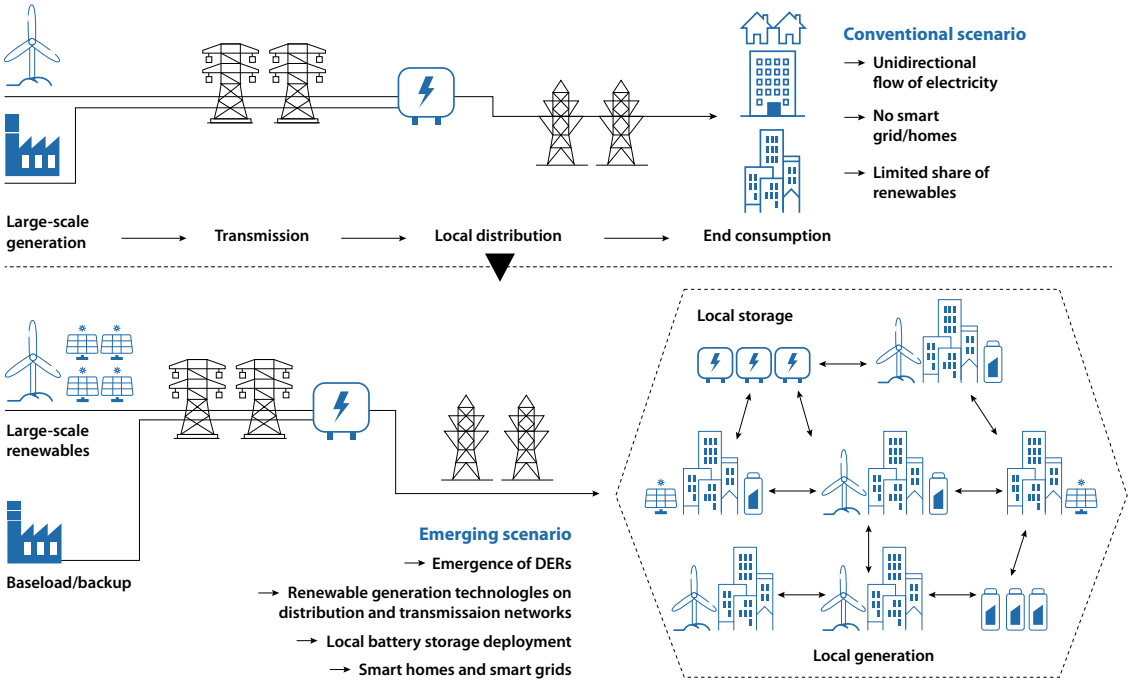
[12] Lazard, LCOE Analizi – 2020, https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2020/

Figure 5 compares the distributed network model and the traditional central network model through a scheme and the advantages of the new model are shown.

This change will replace large electricity companies in the monopolized energy market with a more democratic business model in which final electricity consumers move towards becoming prosumers and can manage their own energy portfolios. Thus, the importance attached to energy efficiency and energy cooperatives will increase, and the installation of small-scale wind and rooftop solar power plants will gain momentum. It will also pave the way for electricity trade among final consumers. As the number of final electricity consumers and the machinery and equipment used for electricity generation as well as of electricity consumption patterns will increase in the distributed electricity network model, it will be important to properly manage the mutual interaction of this big data and the components within the system.

Developed countries experimentally work on new market mechanisms and business models to overcome these difficulties, develop various incentive mechanisms for end users and manage the system that will become more complex.

Figure 5: Schematic Comparison of Traditional Central and New Distributed Networks



Source: https://www.powermag.com/why-the-2010s-were-a-definitive-decade-for-power/

1.5.3. Increasing Digitalization in Production, Distribution and Trade in Electricity Markets

With the increasing tendency towards energy resources such as wind energy in the world, more countries will switch the energy market to a structure with real-time pricing and a higher number of short-term consensus in order to effectively manage electricity supply and demand. For example, an electricity distribution process has been developed under the coordination of the Australian National Electricity Market Regulator and the Australian Energy Market Operator for a pool and spot market structure where supply and demand are matched on real-time fashion and the market will become operational in 2021[13].

[13] https://www.aemc.gov.au/rule-changes/five-minute-settlement

Transition to real-time settlement in electricity markets will ensure faster response to changing consumer demands in electricity grid services and increase profits, while the cost of electricity used by end consumers will decrease. As the grid integration of renewable energy-based power plants increases, it will become more and more important to predict wind and weather conditions accurately in real time fashion and to create a more reliable electricity network.

Traditional automation and process management models will no longer be sufficient for grid operators, as the number of decision points will increase with big data flows as a result of the adoption of renewable energy and distributed generation while the electricity industry moves towards a real-time market mechanism. More organizations will invest in digitalization, artificial intelligence, and big data analysis. Investments in digitalization, artificial intelligence and big data analysis will reduce uncertainties in business models, automate the processes that are currently performed manually, and boost the efficiency of electricity trade.

Digitalization will pave the way for the interplay and widespread use of machines and devices at all levels of the power system from manufacturing and infrastructure to the devices developed for end users. This great transformation coined as Energy 4.0 will enable the introduction of smart energy systems and optimum power management solutions based on machine-machine and machine-human interactions.

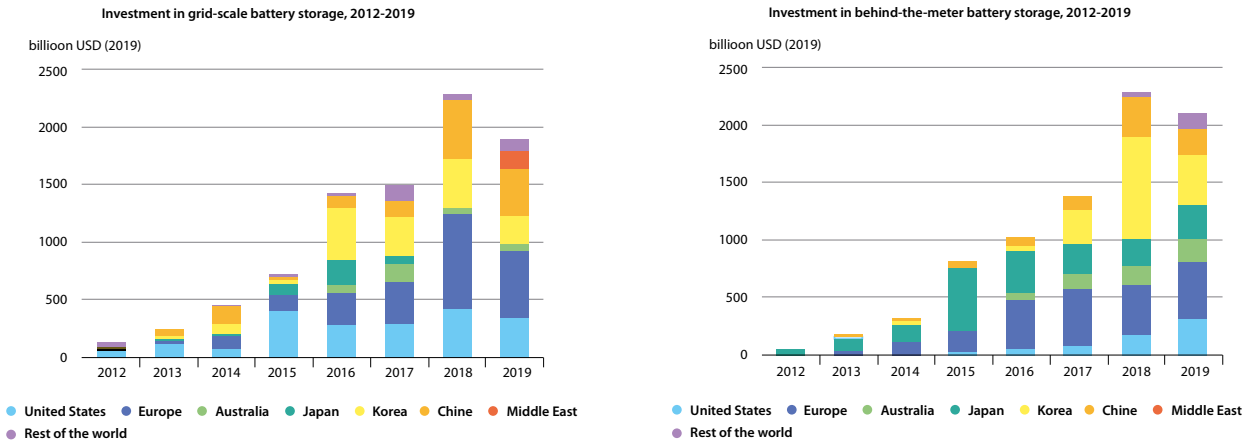
1.5.4. Widespread Use of Energy Storage Systems

It is observed that the upward trend of battery-type energy storage systems in particular will persist due to the reduced costs of lithium-ion batteries, the auxiliary services support offered thereby to the electricity grid, support for the shift and management of peak demand curves and backup power supply functions where necessary.

As shown in Chart-25, investment in battery electricity storage decreased in 2019 by 13% year-on-year for the first time, despite standing over $4 billion. Spending on grid-scale batteries decreased by approximately 15% while investments in behind-the-meter storage decreased by 5%.

However, behind-the-meter batteries are about twice as expensive as utility-scale batteries in USD per kWh. As battery prices globally fall and project developers continue to reduce other cost components in the battery storage system (mounting equipment, wiring and labor), the costs of the entire system will continue to decrease.

Chart 25: Investments in Battery Electricity Storage Systems



Source: IEA, World Energy Investments, 2020[14]

[14] IEA, World Energy Investments, 2020, https://www.iea.org/reports/world-energy-investment-2020/power-sector#abstract

1.6. Energy Investments and Financing

Standing at 31.8 GW in 2002, the installed capacity of Turkey reached 93.2 GW by September 2020 due to the steps taken since 2011 for the liberalization of the energy market and the YEK Law that entered into force in 2005. During this period, all electricity distribution companies were transferred to the private sector, and the private sector gained importance in electricity generation. Due to the new investments made by the private sector, the share of the private sector in electricity generation increased from 32% in 2002 to 77.7% by the end of September 2020. It is beyond doubt that such a huge rise in the share of the private sector in the installed capacity of Turkey can be attributed to financing opportunities.

Table 12: Project Financing in the Energy Sector (in billion USD)

Year/Month	Cash Risk	Non-Cash Risk	Total Commitment
2016/12	31	6	52
2017/12	35	7	55
2018/12	30	5	46
2019/12	27	4	39
2020/6	27	4	39

Source: The Banks Association of Turkey, TSKB

Created through the reporting of 19 Turkish banks every 6 months since 2014, the Project Financing Statistics show that the cash risk of the energy sector including the projects allocated prior to 2016 stands at USD 31 billion. Considered to be mainly composed of the letters of guarantee addressing the Export Credit Agencies for obtaining national loans and addressing the Privatization Authority for privatization processes, the non-cash risk stands at USD 6 billion. Considering the remaining commitment amount, it is known that domestic banks offered a financing of USD 52 billion in the energy sector by the end of 2016.

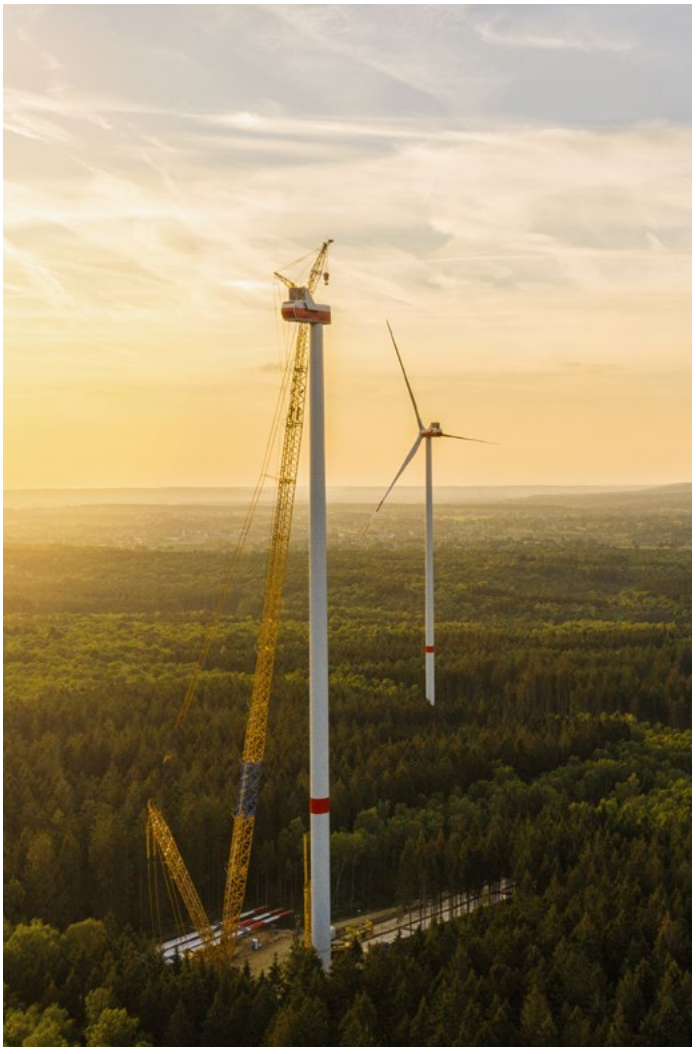
In 2018, a downward trend in electricity sales market prices was coupled with the exchange rate shock. Therefore, it would be appropriate to consider the risk not included in the aforementioned reporting, offered by foreign banks for energy projects and standing at USD 11 billion[15] with the total commitment amount of USD 46 billion as specified in the table to understand the size of the sector in financial markets at the time. In recent years, power plants not included in YEKDEM have been exposed to a high currency risk at times of exchange rate increases, since their proceeds from electricity sales are denominated in TL but the majority of their investment-related liabilities are denominated in a foreign currency. Besides, it is clear that sales prices in the free market stand below the expected levels under the impact of excess supply in recent years. These key points made it almost impossible to repay the loans for fossil fuel-based (coal, oil, natural gas) power plants (both in terms of new investments and the assets taken over from EÜAŞ) through project revenues. For this reason, especially after the sudden increase in the exchange rate in 2018, no new investment demand was made by the actors of energy sector to financing institutions for energy generation based on fossil fuels, and the repayments of the projects financed in previous years constituted the main item of the agenda. Considering the energy projects restructured in the sector, the loans extended for new investments and the repayment of unproblematic projects, it is observed that the finances offered by domestic banks to the energy sector stands at USD 39 billion as of June 2020 according to the Project Financing Statistics of the Banks Association of Turkey.
Electricity sales price remained low during 2016-2020 while the share of renewable energy in Turkey's total installed capacity rose from 43% to 50%. Looking at these rates, it can be said that renewable energy contributed increasingly to the financing composition of the energy sector during the same period.

Renewable energy projects are categorized as environmentally-friendly projects from a sustainability perspective on one hand, they stand out with the opportunity to sell to EXIST at the same price level in line with the current YEKDEM tariff in return for declining fixed investment amount per MW on the other.

For these reasons, the financing of projects benefiting from the existing YEKDEM tariff has dominated the sector in terms of new investment financing in the last couple of years. Currently, renewable energy projects are still on the agenda of lenders thanks to the 6-month extension of time announced by EMRA in September.

Following the "Regulation Amending the Electricity Market Licensing Regulation", the content of which is discussed in detail under the title of "Hybrid Technologies" in the subsequent part of the report, and published in the Official Gazette on March 8, 2020, hybrid investments have also attracted great interest from the energy sector and continue to be evaluated by financing institutions.

Considering the electricity generation investments financed in the past, the following topics come to the fore in terms of financing decisions.



[15] https://www.enerjigunlugu.net/

1.6.1. Investment and Operating Period Risks

If the lender is involved in financing at the beginning of the investment period for greenfield investments, potential cost increases and possible delays in the commissioning of the investment are major risks. Financing institutions have gained experience due to both the failure to commission investments in planned schedule for HEPPs, the first type of resource initiating the story of renewable energy for many creditors in Turkey, and increases in the investment amount. As for the projects the cash flows and financial models of which are structured based on YEKDEM, the timely commissioning of investments to ensure the provisional acceptance thereof by EMRA constitutes the most critical issue for financing institutions. Lenders prefer projects with turnkey and fixed-cost engineering, procurement and construction (EPC) contracts, if possible, to ensure that the investment is commissioned on time and at estimated cost. In the absence of this structure, supply contracts are examined separately and the commitments of suppliers to the investment company are analyzed.

Performance risk is of importance for greenfield investments after the commissioning of the investment or for operational assets with regard to the types of financing offered during the operating period such as procurement financing and refinancing. Projects with guarantee performance in which this risk can be minimized stand out. In addition, the fact that the measurements are made for a sufficient period based on the relevant source plays a critical role for the generation during the operating period to be achieved at expected levels. Risk appetite proved to be higher in former projects where investment and operating risks were eliminated. In the upcoming period, projects that minimize risks in terms of both insurance and related contracts will stand out in terms of financing.

1.6.2. Electricity Sales Agreements

After the electricity market prices remained below the YEKDEM tariff, the lowest of which was 7.3 cents/kWh, in 2014, all of the plants entitled to benefit from YEKDEM filed all relevant applications and started selling under YEKDEM during the subsequent year. As the trend was similar in the following years, the transfer of renewable projects/licenses that could be included in YEKDEM gained momentum and the projects became more feasible due to a rise in capacity factors coupled with a decline in investment costs and emerging technologies. At this point, the right to benefit from YEKDEM, which was originally valid for the power plants commissioned until December 31, 2020, was extended to June 30, 2021 due to the pandemic. However, these power plants will be able to benefit from YEKDEM for a total of 9 years from January 1, 2022 to December 31, 2030. Although public authorities have not yet made a definitive statement regarding the period following the current YEKDEM tariff, EMRA is expected to continue to support at least certain renewable resources with a different incentive mechanism.

The announcement of the new structure as early as possible is critical in order to maintain the 73% share of renewable energy in the rise of total installed capacity on monthly basis especially during January 2015-September 2020. Considering the 2019-2023 Strategic Plan of MENR aiming to achieve a total installed capacity of 56,804 MW including 10,000 MW for SPPs, 11,883 MW for WPPs, 32,037 MW for HEPPs and 2,884 MW in GPPs and BPPs by 2023, it is understood that the public authority expects the continuation of the recent upward trend for WPPs and SPPs within renewables.

Undoubtedly, both the YEKA SPP and WPP tenders which were held in 2017 and 2019 and the processes of which were completed, and the mini YEKA GES tender planned to be held in 2021 will contribute to the achievement of the aforementioned installed capacity. However, the maintenance of an incentive mechanism in addition to YEKAs will also benefit the transformation into capacity of Turkey's renewable energy-based electricity generation potential known to be much higher than its current installed power.

Current downward trend for market prices constitute the most importance obstacle regarding financing for the investors awarded with tenders based on MCP during the connection capacity tenders held in 2017. Especially for areas with higher wind potential, the right to connection capacity was awarded in return for a sales guarantee at a price lower than MCP in case of the sale of electricity to EXIST. These projects are still under development by investors. When negotiations are initiated with lenders for financing, conditions concerning these projects including loan/equity structure in particular will differ when compared to YEKDEM projects as they comprise different structures and risks in comparison with the conditions listed for YEKDEM. In case of refinancing/ procurement financing need etc. with regard to the projects developed within the scope of pre-licenses obtained through the connection capacity tender as well as the projects to be developed based on YEKDEM, it is considered that selling generated electricity through Renewable Energy Supply Agreements (YETA) instead of selling it to the market may allow for the financing of the project under more favorable conditions.

Short-medium term credibility of the company with which the bilateral agreement will be signed, the legal basis of the supply agreement and the structure allowing for a guarantee structure known by the banks will enable lenders to adopt this alternative. In particular, it is considered that the Turkish affiliates of international companies with commitments to combat climate change in global platforms may set the first examples regarding the supply of electricity from renewable energy generators through such agreements.

1.6.3. Commitments Expected from Investors

While financing energy projects, lenders analyze the risks during both the investment period and the operating period and create a financial model for such projects. At this point, financial and non-financial commitments related to the project are requested.

It can be said that the projects in the Turkish energy sector in the past were financed in the range of 60-80% by credit and the remaining parts of them were funded by equity. As mentioned above, the need for equity will be shaped according to the cash flow created specifically for the project and the "debt service coverage ratio" targeted in the project will be clarified.

On the other hand, there will be commitments regarding the principles on the sharing of the cash flow of the project between the lender and the investor.

1.6.4. Energy Investments from an Environmental and Social Perspective

Although referred to as "Green Energy", renewable energy investments may also pose environmental and social risks (negative impact on bird migration paths in WPPs, drilling mud and greenhouse gas emissions in GPPs, the existence of land subject to expropriation and involuntary resettlement in most of HEPPs, etc.). The banking sector is increasingly focusing on environmental and social issues in financed investments, and takes care to perform assessments required in terms of environmental sensitivity and social impact both during the construction phase and during the operation phase.

In projects involving environmental and social risks, it is expected that these risks are best identified and managed in accordance with the principles adopted by the world's leading development finance institutions (DFIs). Investors' approach towards environmental and social issues from this perspective both paves the way for direct foreign financing and facilitates access to long-term external financing, especially through development banks.

Projects that meet international standards in environmental and social terms and manage risks with action plans will also be able to access finance through the issuance of "green bonds", the examples of which have grown rapidly in the world in recent years. In this sense, environmental and social issues will come to the fore both in accordance with the commitments of DFIs to offer financing to the investments intended for combating climate change as repeated in COP-21 under the Paris Agreement, and in terms of accessing alternative financing opportunities such as the issuance of green bonds.

Within the scope of the "Green Energy Tariff" which was published by EMRA on July 23, 2020 and the examples of which are available across the world, it is planned to develop a transparent and reliable verification mechanism and create a Renewable Energy Resource Guarantee Certificate (YEK-G Certificate) under the green electricity tariff to make sure that the energy used by consumers that would like to supply electricity based on renewable energy resources in Turkey is generated out of these resources. "Regulation on Renewable Energy Resource Guarantee Certificate in the Electricity Market" was published in the Official Gazette of November 14, 2020 in order to establish a YEK-G system and market infrastructure. As the number of institutions and organizations focusing on fight against climate change in the world and Turkey and they integrate sustainability approach into their corporate strategies, the demand for renewable energy-based electricity will increase, constituting a driving factor for renewable energy investments.

1.6.5. Project Collateral Structure

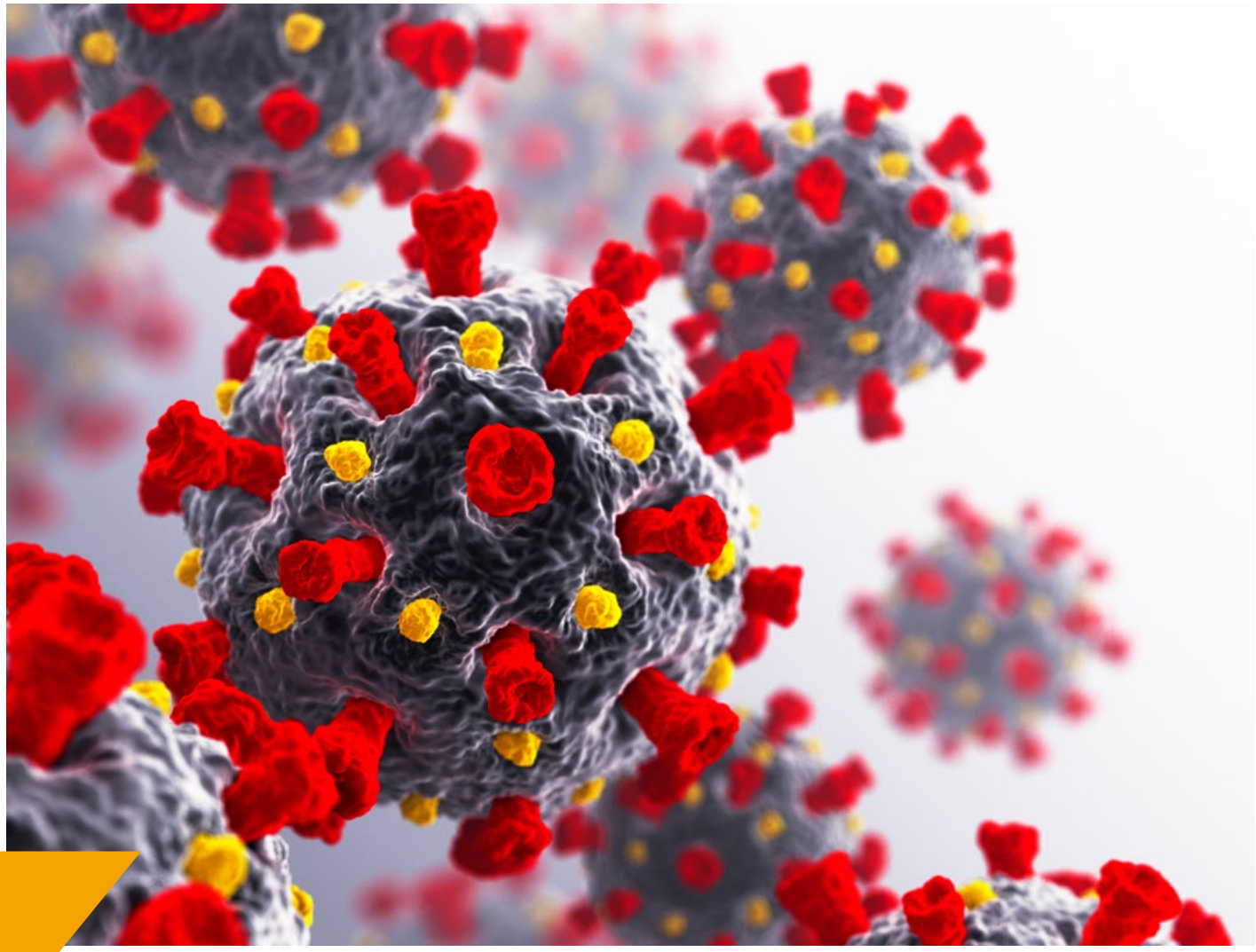
Energy projects are closed-circuit investments financed mainly via a project finance approach. In this context, the project owner company usually establishes a special purpose company for the relevant investment. When financing an investment or acquisition in the energy sector, financing institutions consider that the loan will be repaid with the sales prices to be obtained from the electricity to be generated in the plant. In this sense, the primary collateral in financing energy generation investments is the assignment of the electricity sales amounts to the lending bank.

Apart from this, the pledge of the accounts and shares of the special purpose company established for a special purpose, the pledge of movable property such as all machinery and equipment and mortgages on real estate, if any, constitute other project collaterals. In addition to the project collaterals, the project equity obligations and project completion collaterals are obtained for the construction period and the sponsor guarantee for the operating period, which can be lifted if certain retrospective and prospective tests are passed.


ENERGY

Themes Standing Out in 2020

This section of the report gives details of the themes discussed and standing out for the energy sector during 2020 as well as a more comprehensive perspective on these headings.



2.1. Short-Term Impact of Covid-19 on the Energy Sector

Covid-19 is a virus first identified on January 13, 2020 as a result of a research conducted on a group of patients who developed respiratory symptoms (fever, cough, shortness of breath) in Wuhan, China in late December 2019[16]. The epidemic spreading to the entire world within a short period as three months was declared by the World Health Organization (WHO) as a pandemic - an epidemic threatening more than one geography simultaneously - on March 12, 2020.

As of the end of October, more than 46 million people were infected with the disease while a total of 1,195,000 people were reported to have died from this pandemic. In Turkey, the first Covid-19 case was diagnosed on March 11, 2020. According to the data announced by the Ministry of Health of the Republic of Turkey, the total number of cases were reported as 283,270, the total number of recovered cases as 375,367 and the total number of deaths as 10,252 as of October 31, 2020. Affecting the whole world and bringing the social and economic life to a standstill, the Covid-19 pandemic seriously changes our lifestyles, ways of doing business and habits. This change introduces positive interaction for some categories while it has a negative impact on certain categories. Due to the pandemic and the measures taken against the pandemic, problems began to occur in the world economy one after another during the first quarter of 2020. In its "World Economic Outlook (WEO)" report published in June 2020, the IMF predicts that the world economy will contract by 4.9% in 2020[17].

[16] https://covid19.saglik.gov.tr/TR-66300/covid-19-nedir-.html
[17] World Economic Outlook, IMF, June 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020

Compared to the estimates at the beginning of January (a growth forecast of 3%), this revision points to an almost 8% decline regarding the growth forecasts of the global economy.

The Covid-19 pandemic is shocking all countries around the world irrespective of developed or developing economies. Globally, the financial support programs of institutions such as the US Federal Reserve (Fed), the European Central Bank (ECB) and IMF aim to stimulate economic and commercial activities. Losses in exports and the shrinkage of international trade volume are the results of disruptions in the provision of intermediate good inputs required for production by the manufacturing industry in the global economy and the bottlenecks experienced in global value chains. Managing Director and Chairwoman of the IMF, Kristalina Georgieva, stated that the economic crisis triggered by the Covid-19 pandemic was more severe than the Great Depression in 1930s[18].

Some restrictions were introduced under the measures taken by the enterprises in our country on their own initiative or upon the guidance of the public authority for fighting against the pandemic. In some facilities, capacity limitations were imposed for halting production or reducing the number of employees so as to reduce contact. Many businesses, particularly in the services and retail sectors, were shut down, and these measures led to a decrease in productivity. In addition to all these measures, travel restrictions, curfews, unpaid leave practices and working hour regulations resulted in a decrease in both production and demand for production in many sectors. Rapid increase in the number of cases and the measures taken to prevent this also significantly affected Turkey's economy just as many other economies. The Covid-19 pandemic caught the Turkish economy in a process where the circumstances triggered by the exchange rate increases during 2018 were still prevailing. Generating an unemployment rate of 13.6% and an inflation rate of 11.0% by the end of 2019, the Turkish economy will shrink by 5% in 2020 due to the impacts of the Covid-19 pandemic according to the projections made in June within the IMF's "World Economic Outlook" report[19]. Although official growth projections show a more positive outlook, there is no doubt that 2020 was a difficult year in many aspects.

Impacts of the Covid-19 pandemic on Turkey as in many global markets were experienced in many sectors and they still persist. Oil, natural gas and electricity generation sectors, which are the sub-components of the energy sector, are among the sectors negatively affected by the process. In particular, the decisions on the restriction of international flights and intercity trips directly affecting the oil sector as well as the decisions on curfews and the closure of shopping malls, cafes and restaurants affecting the use of natural gas intended for heating and electricity consumption stand out as factors shaping the direction of the Turkish energy sector in the short run. Under this heading, the impacts of the Covid-19 pandemic on oil, natural gas and electricity demand as well as renewable energy are examined first at global level, and then specifically for Turkey.

2.1.1. Oil Sector

A unilateral pressure is available regarding the oil markets due to the production, transport, service and commercial activities slowing down and even coming to a standstill in a myriad of countries due to the Covid-19 pandemic. During this period, the oil storage capacities of countries reached the full level with the slowdown and then standstill in demand.

This development reduced the price of US West Texas Intermediate crude oil to a negative level in April for the first time in its history. In the same period, even the 10 million barrels cut down resolution issued by the oil producing countries that are members of the Organization of Petroleum Exporting Countries and its Allies (OPEC+) was not enough to solve the problem of excess supply.

[18] IMF, https://www.imf.org/external/pubs/ft/fandd/2020/06/turning-crisis-into-opportunity-kristalina-georgieva.htm
[19] World Economic Outlook, IMF, June 2020, https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020

In a statement made in August, the Executive Director of IAE Fatih Birol, PhD, said that there was a huge excess supply in oil at global markets and there would be severe downside pressures on the oil demand and prices in case of a second wave of the Covid-19 pandemic. Considering April as "Black April", Birol noted that oil consumption in China, which was decisive for the course of global oil consumption, got close to the levels prevailing before the Covid-19 pandemic. IEA, EIA and OPEC share current developments as well as global oil demand and price forecasts in their monthly oil sector reports. With the restrictions imposed by countries within the scope of the Covid-19 and the clear manifestation of their impacts, all institutions predicted a decrease in oil demand for 2020 within their reports published in April although their levels were different. In January, when the Covid-19 pandemic broke out, the barrel price of Brent crude oil was around USD 65-70 while it stood around USD 40 as of the end of October due to the impacts of the pandemic. Turkey is a net importer regarding the consumption of oil and petroleum products and therefore is directly affected by price and exchange rate movements occurring in the global markets. This decline in oil prices has made a positive contribution to Turkey's current account balance. However, it will be important to what level the prices will rise following the pandemic.

Data of EMRA reveals the impact of the Covid-19 pandemic on the consumption of petroleum products during April and May 2020. Rising by 5.2% in the first quarter of 2020 when compared to the first quarter average of 2017-2019, the consumption of petroleum products declined by 27% and 27.3 in April and May, respectively. The two-month negative growth turned to positive in June 2020 and there was a rise of 2.6% when compared to the averages of 2017-2019. Standing at 2,533,444 tonnes during April 2017-2019, the consumption of petroleum products declines to 1,717,105 tonnes in 2020 while the consumption for the average of May 2017-2019 standing at 2,510,319 tonnes shrank to 1,825,667 tonnes in May 2020. During June 2020, the level consumption rose over the average level of 2017-2019 again. Standing at 2,417,293 tonnes for June 2017-2019, the average consumption of petroleum products was 2,480,680 tonnes during 2020.

An analysis of import levels showcases a decline surpassing 40% in April and May. A comparison of averages during January-March 2020 with the averages of the same period during 2017-2019 shows a drop of 29.4% while a drop of 48.1% and 41.4% is observed during April and May, respectively. As confirmed by the data of EMRA, a serious decline was observed regarding fuel consumption during April and May as a result of the measures taken to curb the spread of the Covid-19 pandemic. Within the framework of the normalization steps introduced in June, it is observed that consumption and imports increased to the levels materializing during previous years. However, the fuel distribution sector suffered serious revenue losses as both individual and industrial use fell sharply during April and May. It is considered that loss of workforce and forced handover may be brought to the agenda in parallel with the loss of income in the dealer network in case of the recurrence or continuation of the drops in question. In case of the ordinary rise of diseases other than the Covid-19 pandemic as well as the second wave or second peak of the pandemic during winter, restrictions may be introduced again at country level. Considering the current global trend, it is thought that the impact of the pandemic on oil demand poses a risk not only for the entire period of 2020 but also for 2021.

2.1.2. Natural Gas Sector

As a result of the rapid spread of the pandemic on a global scale, natural gas consumption also decreases at global level due to the decline in industrial activities and electricity generation during the first quarter of 2020. This decline in consumption follows a course parallel to the decreases in other energy resources. Following a similar course with oil in terms of demand and pricing, natural gas prices in April show that record drops of 40% were experienced when compared to the first months of 2020. While this decrease in natural gas prices is expected to recover rapidly during 2021, record drops are also the case regarding new well drilling activities and LNG investments[20]. During the said period, a decline in demand significantly increases storage capacities concerning natural gas as in oil[21].

The IEA's "Gas 2020" report published in June shows that the demand in the global natural gas markets decreased significantly while the level of consumption in 2020 is expected to decrease by 4%. Accounting for 75% of the global gas consumption and hosting mature markets, North America, Europe and Asia will also be affected by this contraction[22]. The same report estimates that the growth will not match the predictions made during the pre-crisis period although a recovery is expected in global gas markets during 2021. In January, when the Covid-19 pandemic broke out, Henry Hub natural gas price was above the level of USD 2.0 (per thousand BTUs or 0.0283 m^3) while the price of natural gas fell to USD 1.7 /'000 btu during the second quarter of the year due to the pandemic-related impacts. Rising over USD 2.0 /'000 btu again in August, the price of natural gas stood around USD 3.4 /'000 btu as of the end of October.

Turkey, a net importer of natural gas, generated a natural gas consumption of 46 bcm on average during the last decade. Although the demand rose to 53 bcm in 2017, it dropped to 46 bcm in 2019. It is estimated that the demand will not exceed 45 bcm during 2020. An analysis of EMRA's sectoral report data reveals that the measures taken in the wake of the Covid-19 pandemic affected natural gas consumption. A downward trend and seasonality have been the case for monthly natural gas consumption since January 2017. Reaching the highest level prior to the measures taken against the Covid-19 measures, in January 2020 since 2017, the consumption reached the lowest level of the last four years in June 2020.

[20] WB, https://blogs.worldbank.org/opendata/will-natural-gas-and-coal-prices-recover-coronavirus-covid-19-slump
[21] EIA, https://www.eia.gov/naturalgas/storage/dashboard/
[22] IEA, https://www.iea.org/reports/gas-2020

2.1.3. Electricity Sector

A considerable decline materialized regarding the global electricity demand due to the restrictions introduced by many countries to prevent the spread of the Covid-19 pandemic. The decline in the electricity demand triggered by the standstill in industrial and services sectors as well as commercial operations outweighed the household-based electricity demand rise. The Covid-19 pandemic was not only limited to a negative impact on the electricity demand, but also caused a change in the hourly profile of electricity demand. The slowdown in industrial production and trade activities resulted in the shifting of the electricity demand profile observed during Sundays prior to the pandemic to weekdays in many countries. The IAE's "Global Energy Outlook 2020" report published in April shows that the global electricity demand decreased by 2.5% during the first quarter of 2020 year-on-year[23].

The IEA predicts that global electricity demand will fall by 5% in 2020[24]. It is estimated that this will be the highest decline since the "Great Depression" and calculated as eight times the fall observed in 2009 due to the global financial crisis. Prevailing in China and India in 2009, the growth kept the shrinkage of electricity demand within a certain margin at the time. However, it is stated that demand growth is out of the question for any major country in 2020.

With the rapid spread of the Covid-19 pandemic, there has been a significant decrease in electricity demand in our country just as in global markets. It was observed that the increased consumption of households due to the restrictions could not recover the decline in the industry, services and trade sectors due to the slowdown in economic activities. The dramatic decline in electricity demand led to a decrease in electricity sales prices as there was already a surplus in the market. Dropping from January to May 2020 with the impact of the pandemic, Turkey's electricity generation rose again with the recovery of economic activities as a result of the normalization process. The decline in generation throughout the relevant period originated from thermal power plants.

An analysis of daily average electricity consumption data shows the levels in April and May 2020 as the lowest average consumption levels of the last two years. Fluctuating between 730,000 MWh and 860,000 MWh in 2019, the daily average electricity consumption stood at 637,686 MWh and 576,438 MWh in April and May 2020, respectively. It is considered that the most important factor for this decline was the slowdown in industrial facilities. In June, the daily average electricity consumption rose to around 750,000 MWh as a result of the normalization steps. The daily average consumption level reached the levels of the previous year in June and August with the expansion of normalization steps and prevailing climatic conditions.

[23] IEA, https://www.iea.org/reports/global-energy-review-2020
[24] IEA, https://www.iea.org/reports/global-energy-review-2020

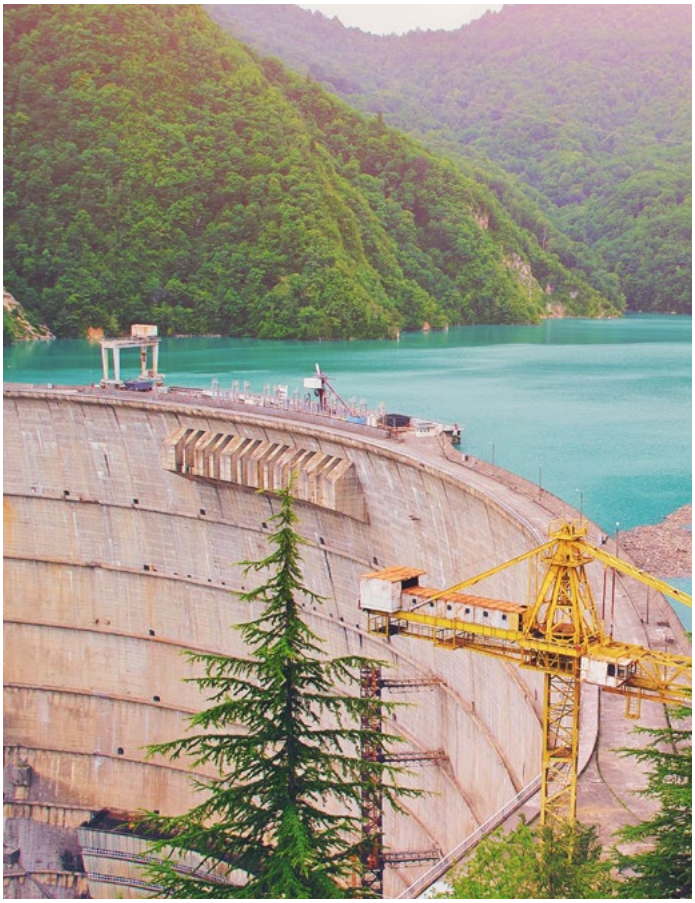
2.1.4. Renewable Energy Sector

The IEA predicts that "additional" renewable electricity capacity will decrease in 2020 (year-on-year) for the first time since 2000. The IEA estimates a contraction of 13% in 2020 while this change represents a 20% revision when compared to the previous estimates of the IEA. According to the report "Covid-19 Impact on Electricity" published in August 2020[25], across all major regions, the power mix shifted towards renewables due to depressed electricity demand, low operating costs and priority access to the grid through regulations. The share of variable renewables in the electricity mix depends on many factors: wind and solar parks in operation, weather conditions, and total demand.

According to the report, in several EU countries, in particular Italy, Spain and Germany, new records were reached during the lockdown period.

The renewable energy sources in Turkey became the only source of energy generation recording a 1.5% growth during the first quarter of 2020. Reduction in electricity consumption and, accordingly, electricity generation following the measures taken against the Covid-19 pandemic resulted in a decline concerning the generation of electricity based on thermal power plants. The share of renewables in electricity generation was over 60% in April and May. While the share of renewables in total electricity generation stood at 66.1% and 62.2% in April and May, respectively. Upon the introduction of normalization steps, thermal power plants became operational again. Standing at 44.2% in June, the share of renewables in electricity generation was 42.2% and 40.5% in July and August, respectively.

The electricity generation sector was affected the most in terms of pricing by the pandemic process in which many sectors came to a standstill. Although there was a decline in the generation of electricity based on natural gas and coal throughout this period dominated by depressed industrial demand and elevated household demand, the share of renewables within electricity mix increased owing to YEKDEM incentives. The Covid-19 pandemic also directly affects renewable energy investments. Since most of the equipment intended for wind and solar power plants was imported, supply difficulties were experienced in ongoing investments. Therefore, the period for fulfilling the condition for the commissioning of the generation plants eligible for YEKDEM by December 31, 2020 was extended to June 30, 2021. It is observed that another impact of the Covid-19 pandemic was relevant to pre-license applications based on wind energy. According to the announcement by EMRA on September 17, 2020, the wind-based pre-license applications to be filed between October 5-10, 2020 were postponed until another announcement[26].



[25] IEA, Covid-19 Impact on Electricity, https://www.iea.org/reports/covid-19-impact-on-electricity
[26] EMRA, https://www.epdk.gov.tr/Detay/Icerik/5-9212/ruzgar-enerjisine-dayali-onlisans-basvurulari-hk

2.2. Turkey's Hydrocarbon Explorations and Discoveries

Being a country highly dependent on foreign sources for oil and natural gas, Turkey has focused on marine areas for the exploration of hydrocarbons and taken remarkable steps in recent years. There is no doubt that any recent and prospective developments will have positive economic repercussions such as improving the foreign trade balance and reducing the need for foreign currency. Apart from this, it is also evident that such actions and attempts will be decisive for Turkey's foreign policy direction. From this perspective, it is observed that political-diplomatic matters relatively stand out regarding Turkey's hydrocarbon exploration attempts in the Eastern Mediterranean and technical-economic aspects are more decisive in its exploration and discovery activities in the Black Sea. Due to this difference, the status of Turkey in terms of hydrocarbon explorations will be examined under two headings on the basis of the Mediterranean and Black Sea sections.

There is no doubt that the most important matter concerning exploration activities in marine areas is the agreement of riparian states on both the continental shelf[27] and exclusive economic zone (EEZ)[28].

[27] Any area of water starting from the land of a country/state and extending up to 12 nautical miles (22 km) is defined as territorial waters (territorial sea). In this area, states have all sovereignty rights bestowed upon them over lands. The second adjacent 12-mile area starting right after the first 12-mile area is called the contiguous zone. Riparian states have limited jurisdiction/sovereignty to enforce fiscal, sanitary, customs or immigration laws in this region, and this sovereignty is conditional on the occurrence or possibility of a violation. "Continental shelf" is the natural extension of a coastal state under the sea. 2 identification criteria are available for the continental shelf: i) the area extending from the coast to the point where the sea reaches a depth of 200 meters, ii) the area extending from the line where the territorial waters come to an end to the area 200 miles beyond this line. In terms of the continental shelf, there is no need for any state to declare these rights separately and the state in question owns these rights naturally. However, the continental shelf boundary must be determined by an agreement with other riparian states based on the principle of equity. The coastal state has sovereignty over mines/natural resources, other inanimate resources and creatures living on the seabed in these areas.

[28] An Exclusive Economic Zone (EEZ) refers to the water table within the area up to 200 nautical miles from the point where the territorial waters come to an end as well as the marine area on the seabed and below the seabed, where the coastal state is granted exclusive economic rights and powers. EEZ is defined as follows in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), one of the main documents for the law of the sea: "It is an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in the Convention (Art. 55-75), under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by the relevant provisions of this Convention."

Figure 6: Exclusive Economic Zones of the Countries Bordering the Black Sea

If the 200-mile distance a country will calculate from its own coast to the open sea coincides with the 200-mile distance of another riparian country, then the two countries in question (sometimes more than two countries) are expected to negotiate and reach a fair solution considering the interests of the parties. As a matter of fact, this was the method followed in the Black Sea. First of all, Turkey signed the "Agreement on the Delimitation of Continental Shelf in the Black Sea" with the Union of Soviet Socialist Republics (USSR) in 1978.

Then, Turkey declared an EEZ in the Black Sea in 1986 following the declaration of EEZs by the USSR and Romania in the Black Sea in 1984 and 1986, respectively. The announced EEZ corresponds to the continental shelf boundary that was previously identified. With the dissolution of the USSR in 1991, the former borders were also valid for Georgia, the Russian Federation and Ukraine in line with the continuity of border treaties. An agreement was signed with Bulgaria in 1997.

As can be seen from the map in Figure 10, an equitable division was achieved in the Black Sea and the parties accepted this sharing peacefully[29]. In the Mediterranean, there is no agreement similar to the one in the Black Sea. Moreover, Turkey has problems regarding "territorial waters and the continental shelf" with Greece in the Aegean Sea. Originally identified as 3 miles in the Treaty of Lausanne, Greece's territorial waters were extended to 6 miles in 1936. To make matters worse, it would like to extend its territorial waters to 12 miles for the last 30 years by referring to the 1982 United Nations Convention on the Law of the Sea (UNCLOS). Therefore, the border of the continental shelves between Turkey and Greece have not yet been set.

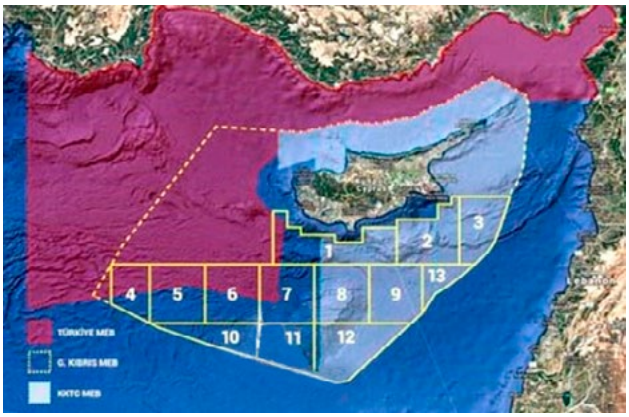
2.2.1. Hydrocarbon Explorations in the Mediterranean

Wishing to register its own sovereignty in the Mediterranean, Turkey signed the "Deal on the Delimitation of Marine Jurisdiction Areas" with Libya on November 27, 2019, creating a border area of 18.6 miles (around 30 km) with Libya. Thus, it set the continental shelf and EEZ boundary in the southwestern sea area. More importantly, the EEZ boundaries created after the memorandum of understanding signed with Libya will require the approval of Turkey concerning all pipeline projects to be passing through this zone.

This step is of critical importance for the energy equation in the Eastern Mediterranean. The map in Figure 7 summarizes Turkey's dispute with Greece and the Greek Cypriot Administration of Southern Cyprus (GCASC). The 3D seismic data collected within the scope of TPAO's exploration activities in the Mediterranean constitutes a valuable data set for revealing the potential of the region. In line with the seismic data collected, a total of 18 marine exploration wells have been drilled in Iskenderun and Mersin bays since the 1960s to test the hydrocarbon potential of the region.

[29] After Russia's annexation of Crimea, the Ukrainian EEZ narrowed towards the west and the northern part of the map is out of date. However, this does not affect the border of Turkey's EEZ.

Figure 7: Disputed EEZ Plots in the Eastern Mediterranean

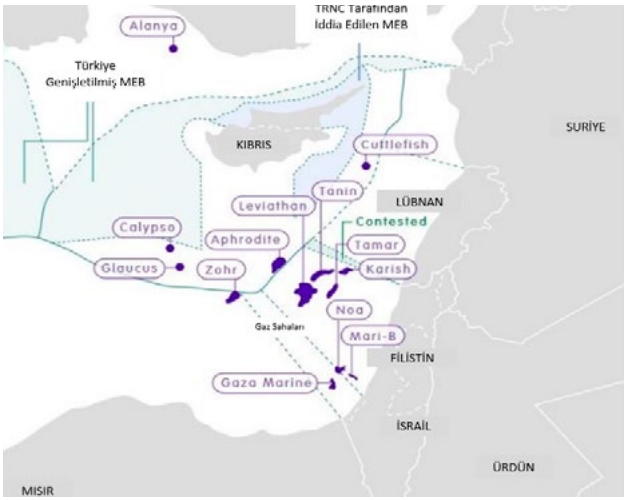


There are 13 plots named/divided by GCASC in the region. The plots No. 1, 2 and 3 are located in the north of the southern edge of the island while the plots No. 4, 5, 6, 7, 8, 9 and 13 are located in the middle part and the plots No. 10, 11 and 12 are located the southernmost part of the island. The lots No. 10 and 11 are the only two lots over which there is no conflict between the areas claimed by Turkey and the Turkish Republic of Northern Cyprus (KKTC) and the EEZ declared by GCASC. The plots No. 1, 2, 3, 8, 9, 12 and 13 are in conflict with the claims of GCASC due to the rights of TRNC while the plots No. 4, 5, 6 and 7 are in conflict due to the EEZ declared by Turkey.

According to TPAO, signs of gas and oil have been encountered regarding these wells at various levels. Execution of explorations through TPAO's own resources owing to the drillships added into the inventory of TPAO includes Turkey, which has lagged behind in many aspects, into the equation. Execution of 8 drills in total through Yavuz and Fatih drillships in the Eastern Mediterranean between October 2018 and July 2020 must be evaluated in this light. According to Statista, proved natural gas reserves in the world are around 7.02 quadrillion cubic feet (approximately 198.8 trillion m^3). BP announced this value (end of 2018) as 196.9 trillion m^3 in its 2019 report. In other words, it is possible to think that the proved natural gas reserves of the world are around 200 trillion m^3 (200,000 bcm). The amount of recoverable natural gas reserves discovered during the explorations intended for the territorial waters of Israel and Egypt is around 2.1 trillion m^3.

When the discoveries of GCASC are added into this figure, the total amount is around 2.5 trillion m^3. In other words, the total known natural gas reserves in the Eastern Mediterranean are approximately 1% of the existing world reserves. On the other hand, the estimated quantity of reserves is higher for the areas on which no exploration activity has been performed yet but which is thought to have natural gas based on the analysis of available seismic and geological data. In 2010, the natural gas reserves in the region (Levant basin + Nile Delta basin) are around 10 trillion m^3 according to the most-cited estimate published by the "United States Geological

Figure 8: Key Exploration and Discovery Areas in the Eastern Mediterranean



Source: Eastern Mediterranean gas: testing the field (energy-reporters.com)

Survey" in two separate reports. It is stated that most of this quantity (6.3 trillion m^3) is located in the territorial waters of Egypt and especially in the Nile Delta basin[30]. In 4 of the important areas (Aphrodite, Calypso, Glaucus, Cuttlefish) in the Eastern Mediterranean where exploration activities and discoveries are the case, GCASC performs activities. A total of 6 fields (Leviathan, Tamar, Tanin, Karish, Noa and Mari-B) represent the areas where Israel is performing production activities. Boasting the largest reserve discovered in the Eastern Mediterranean, Zohr field belongs to Egypt. Table 13 summarizes the situation in the region in terms of production-discovery-exploration activities in terms of both reserves and international actors.

[30] USGS, Assessment of Undiscovered Oil and Gas Resources of the Levant Basin Province, Eastern Mediterranean, Fact Sheet 2010-3014, March 2010 (http://images.mofcom.gov.cn/lb/accessory/201008/1282430618252.pdf) and USGS, Assessment of Undiscovered Oil and Gas Resources of the Nile Delta Basin Province, Eastern Mediterranean, Fact Sheet 2010-3027, May 2010 (http://images.mofcom.gov.cn/lb/accessory/201008/1282430618252.pdf).

Table 13: Key Exploration and Discovery Areas in the Eastern Mediterranean

Country	Field	Type	Size (bcm)	Shareholding Structure
Egypt	Zohr	Production	850	50% Eni, 30% Rosneft, 10% BP, 10% Mubadala (UAE)
	West Nile Delta	Production	142	83% BP, 17% DEA (Germany)
	Norus	Production	5,642	75% Eni, 25% BP
	Atoll	Production	20	100% BP
	Baltim	Production	55	50% Eni, 50% BP
	Other Small Fields	Production	623	40% Eni, 25% BP, 20% Mubadala
Israel	Leviathan	Production	305	40% Noble
	Tamar	Production	110	36% Noble
	Other Fields	Production	140-220	47% Noble
GCASC	Aphrodite (Plot 12)	Discovery	180	35% Noble, 35% BP, 30% Delek (Israel)
	Calypso (Plot 6)	Discovery	140-220	50% Eni, 50% Total
	Glaucus (Plot 10)	Discovery	Likely	60% ExxonMobil, 40% Qatar Petroleum
	Cuttlefish (Plot 3)	Discovery	-	50% Eni, 30% Total, 20% KoGas
	Plots 2 & 9 (2013)	Exploration	-	60% Eni, 20% Total, 20% KoGas
	Plot 11 (2013)	Exploration	-	50% Eni, 50% Total
	Plot 8 (2017)	Exploration	-	50% Eni, 50% Total
	Plot 7 (2019)	Exploration	-	50% Eni, 50% Total
Lebanon	Plots 4 & 9	Exploration	100	40% Eni, 40% Total, 20% Novatek
Palestine	Gaza Marine	Discovery	28	90% BP
Turkey	Plots 2 & 7	Exploration	-	TPAO
	Antalya	Exploration	-	TPAO

Source: John V. Bowlus, "Eastern Mediterranean Gas: Testing the Field", European Council on Foreign Relations, May 2020, https://www.ecfr.eu/specials/eastern_med/gas_fields, TSKB

As an island country with low heating burden due to its hot climate, an underdeveloped industry and small population, GCASC will have an annual natural gas consumption of 0.5 to 0.6 bcm at most. Therefore, investing in a reserve that will last for 300 years for its own domestic consumption will only be meaningful if a solution is developed for transporting this gas to other markets. On the other hand, Israel's total discovered and proved natural gas reserves amount to approximately 1 trillion m3. Almost half of this amount is expected to be exported. However, conditions are not yet ripe for large-scale exports. While the Palestinian and Jordanian markets are extremely limited in size, Egypt's recent major discoveries make this option formidable in many aspects. In January 2020, Israel started exporting the gas it extracted from the Leviathan and Tamar fields to Egypt. Egypt's LNG terminals in Damietta and Idku have enough flexibility to send this gas to Europe, but the pipeline option is still more attractive in commercial terms for Israel.

It is accepted in many aspects that the pipeline option will be more economic for the Eastern Mediterranean gas. That is why Egypt, Israel, GCASC, Greece and Italy came together to discuss the implementation of the EastMed submarine pipeline project. The memorandum of understanding signed between Turkey and Libya knocked the bottom of this project at least for now[31]. As a matter of fact, Italy did not become a party to the Eastern Mediterranean Pipeline Agreement signed on January 2, 2020. On the other hand, it is estimated that the EastMed project expected to be longer than 2,000 kilometers will require at least USD 6-7 billion in investment.

[31] Although third states are allowed to lay pipelines and cables on a continental shelf within the scope of 1982 UNCLOS, the coastal state has the right to speak in terms of the places through which the line will pass. It is obvious that Turkey will raise any and all difficulties against such a project expected to follow the route of Crete-Greece-Adriatic Sea-Italy. Because, Article 79(3) of the UNCLOS reads as "The delineation of the course for the laying of such pipelines on the continental shelf is subject to the consent of the coastal State."

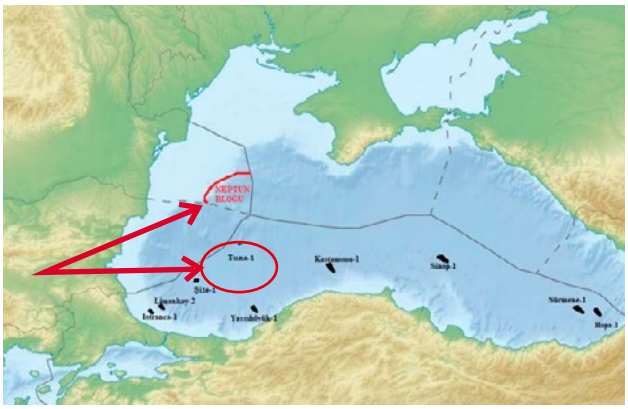
Transporting the natural gas to Turkey (through a pipeline or as LNG) and conveying it to the European border (Greece and Bulgaria) over the domestic network of Turkey constitute a more economic option in every aspect. There is no doubt that Turkey hosts the largest natural gas market of the region and the most developed storage, transmission and LNG import infrastructure. Similarly, Turkey continues to work towards becoming a natural gas trading hub in the region for many years. A natural gas market was launched in 2018 at EXIST established in Istanbul to be the first energy exchange of the region so as to set the reference gas price of the region through this exchange. When it can take steps such as making available to the private sector the contracted gas transported to the country over pipelines and obtaining permission from suppliers to sell this gas to other countries after it is priced, Turkey will maintain its potential to be a significant regional center for natural gas trade.

2.2.2. Natural Gas Discovery in the Black Sea

Hydrocarbon exploration activities regarding Turkey's territorial waters made progress in the 2000s. Discovery of commercial natural gas in Ayazlı-1 well in 2004 boosted hopes while British Petroleum (BP) initiated deep-sea explorations in Eastern Black Sea in 2006. Taking over the license from BP in 2008, TPAO accelerated exploration activities in cooperation with companies such as Chevron, ExxonMobil and Petrobras. Performing off-shore exploration activities for a while, TPAO aimed to discover natural gas reserves in the west of the Black Sea and oil reserves in the east thereof. Adding one seismic ship (Oruç Reis) and three drillships (Fatih, Yavuz and Kanuni) to its inventory in recent years, TPAO continues to perform its activities in the Black Sea as well as the Mediterranean. It is important that these ships can perform exploration-discovery activities without depending on the busy schedule, political preferences or pure profit-oriented positions of foreign chartering firms.

These activities bore their first fruit in the Black Sea. On August 21, 2020, it was announced by President Erdoğan that a natural gas reserve of 320 bcm was discovered in Turkey's EEZ in the Black Sea. It was stated that a depth of 2,115 meters was drilled into Tuna-1 well within the field of discovery, Sakarya, an additional 1,415 meters was drilled after reaching the seabed and the total current depth of 3,530 meters would be increased so as to see potential reserves in the subsequent tables. Approximately 2 months later, President Erdoğan announced on October 17, 2020 that the estimates regarding the natural gas reserve in the well was increased by 85 bcm, resulting in a total amount of 405 bcm and the activities regarding the well were completed after reaching a depth of 4,775 meters.

Figure 9: Some Hydrocarbon Fields Explored in Black Sea



Additional technical surveys are required for the finalization of the reserve figures, which have been announced and are nothing but estimates. New drills will be required to clearly identify the geological and geophysical texture of the gas field. It is considered that a minimum period of year will be required to learn about the reliable proven reserves whose framework will be set by discovery wells and detailed reservoir modeling. Potential roadmap steps include the development of a concept on how to generate natural gas based on information such as water depth, the geological characteristics of the underwater terrestrial structure and wavelengths and the construction of platform, underwater and surface facilities. As shown on the map in Figure 9, the area called "Sakarya Natural Gas Field" and encompassing Tuna-1 well is close to the Neptune Block (Domino field) where Romania previously found natural gas at a water depth of 900 meters.

This discovery of Turkey on its own uncontested EEZ is of particular importance for revealing that it can produce gas at a certain level and under economic conditions. Although the potential amount of gas in the discovered field is not an extraordinary figure and does not currently affect the global gas market, this discovery may attract the attention of international oil companies to the Black Sea. Economic evaluations related to the discovery are presented below:

- Discovered natural gas is a high-quality gas called "dry gas" that does not contain harmful substances and has easier production stages. Due to this nature, it is considered that extracting and offering the gas for consumption will be a profitable investment in economic terms.
- The discovery announced will not have a direct impact on the economy initially. However, considering the total current deficit figure of USD 581.7 billion covering last 20 years (2000-2019) and the net energy import (import-export) of USD 583.1 billion in the same period, it is certain that any oil and gas to be extracted at an appropriate cost irrespective of its size will positively affect the Turkish economy. It is understood that oil and natural gas will continue to be in our lives until 2050, even in the most optimistic and greenest scenarios. In this respect, it is clear that the reserve discovered will have a positive contribution in terms of economy.
- This discovery may make it possible to overcome the psychological barrier caused by the negative developments experienced regarding oil-gas explorations up to now. Verification of the estimated reserve in this field will be a strong incentive for Turkey to perform exploration activities in other fields. Given that each drilling might cost several hundred million USD, it will be more probable for Turkey to make more spending in this field within Turkey upon the verification of the reserve. Strengthening of the "upstream" side of the oil and gas industry in the medium term is a possibility that should not be underestimated.
- Turkey's average natural gas consumption during the last decade stands around 45 bcm. Although the national demand rose to 53 bcm in 2017, it dropped to 46 bcm in 2019. It is estimated that the demand will not exceed 45 bcm during 2020. Size of the announced natural gas reserves is equivalent to about 9 years of natural gas demand of Turkey at current levels.
- When the first-production operations start, it is very likely that generation (maximum gas to be extracted from the field) will be limited a couple of bcm within the framework of the traditional production growth expectation. Plateau production levels (presumably 10-12 bcm at most) will be achieved in the following years. Therefore, it must be expected that the field will be operational for a minimum period of 30 years following commissioning if no new discovery is made.
- As known, long-term contracts set natural gas import price via the formulas the details of which are not disclosed to the public, except for spot procurements. The most important variable of the formula is the oil price. A rise in oil prices also increased natural gas procurement prices in the past. It must be remembered that the Brent crude oil price currently standing around USD 40 /barrel skyrocketed to USD 115 /barrel in the past, creating a bounce for natural gas prices. There were some periods during which the Russian gas estimated to be currently around USD 180 /'000 m^3 nearly reached USD 500 /'000 m^3. Therefore, it would be more appropriate to take the average of last two decades while calculating the economic value of a reserve for a country like Turkey that can be considered as an importer by 99%.
- An annual production amount of 10 bcm - an optimistic estimation - to be achieved in the discovered field 4-5 years later will meet 16-18% of Turkey's natural gas demand by considering the potential consumption level prevailing during that period. This corresponds to an annual value of USD 2-2.5 billion for Turkey ranked the 6th largest natural gas importer of the world following Germany, Japan, China, USA and Italy.
- Transportation of the gas through the pipelines to be laid under the sea will be another significant cost item. As the gas transmission projects involving Turkey up to now were always built over terrestrial lines, it is not easy to estimate the cost of an underwater line. Variables such as water depth and pipe diameter significantly affect the cost. The exact investment amount of Russia's gas transmission line in the Black Sea, which can be taken as a precedent, is also unknown. Besides, it is estimated that the cost will be around USD 350-400 million considering international average costs.
- Some natural gas agreements of Turkey will expire in 2021. Therefore, the discovered reserves will prove to be a factor strengthening Turkey's hand regarding the bilateral agreements to be signed in the future. Table 14 shows that the gas procurement agreements amounting to 18.3 bcm of natural gas will expire before the end of 2021. Considering that the agreement concerning 6.6 bcm of Azerbaijan gas (SOCAR Phase-1) will not be renewed and replaced by SOCAR Phase-2 gas included in the list, it is understood that negotiations must take place for the agreements corresponding to 11.7 bcm of natural gas. A drop in global natural gas prices coupled with Turkey's natural gas discovery will strengthen the hand of our country/companies during these negotiations.

This is also valid for the agreement negotiations to be made for upcoming years.

- Upon the discovery, new financial models must be discussed for the two state economic enterprises on energy: TPAO and BOTAŞ. Unlike privatizations in the electricity sector, it is understood that there may be a preference for public offering concerning TPAO and BOTAŞ.

Table 14: Turkey's Long-Term Gas Contracts

Contracts	Firm	Type	Date of Expiry	Amount (bcm)
Qatar	BOTAŞ	LNG	September 2020	2.10
Russian Federation (Turk Stream)	BOTAŞ	Pipeline Gas	2021	4.00
Nigeria	BOTAŞ	LNG	2021	1.30
Russian Federation (Turk Stream)	Avrasya Gaz	Pipeline Gas	2021	0.75
Russian Federation (Turk Stream)	Bosphorus Gaz	Pipeline Gas	2021	0.75
Azerbaijan	BOTAŞ	Pipeline Gas	2021	6.60
Russian Federation (Turk Stream)	Enerco Enerji	Pipeline Gas	2021	2.50
Russian Federation (Turk Stream)	Shell Enerji	Pipeline Gas	2021	0.25
Algeria	BOTAŞ	LNG	2024	4.40
Russian Federation (Blue Stream)	BOTAŞ	Pipeline Gas	2025	16.00
Iran	BOTAŞ	Pipeline Gas	2026	9.60
Azerbaijan	BOTAŞ	Pipeline Gas	2033	6.00
Russian Federation (Turk Stream)	Akfel Gaz	Pipeline Gas	2043	2.25
Russian Federation (Turk Stream)	Western Line	Pipeline Gas	2043	1.00
Russian Federation (Turk Stream)	Bosphorus Gaz	Pipeline Gas	2043	1.75
Russian Federation (Turk Stream)	Kibar Enerji	Pipeline Gas	2043	1.00
Azerbaijan	BOTAŞ	Pipeline Gas	2046	0.15

Source: BOTAŞ, Enerji IQ Market Report, TSKB

As with many economic issues (in particular energy issues), the political and diplomatic aspects of the natural gas discovery are closely related to the economy of the issue. Considerations regarding this aspect of the discovery are presented below:

- Turkey's natural gas discovery in an uncontested area over which its sovereignty is clearly recognized has confirmed that Turkey will be an actor (even if a minor one) in the natural gas sector for now. Extraction of the natural gas in the Black Sea may eliminate the pressure applied on Turkey in the Mediterranean in the medium term.
- Under the circumstances where there is a depression concerning global natural gas prices and some investments have been cancelled as they are no longer feasible, there has been an appropriate environment for Turkey to develop collaborations with foreign hydrocarbon companies for Sakarya Natural Gas Field the economic value of which is highly certain.
- One of the important cost components will be pipelines to be laid between production wells and the land. Keeping the capacity of the line high due to other (potential) discoveries in nearby areas will increase the costs, but unit costs may decrease significantly if new discoveries are made. This would strengthen Turkey's quest for cooperation with Romania and Bulgaria with regard to hydrocarbon exploration activities.
- Turkey once imported more than half of the natural gas consumed thereby from Russia. In fact, there were years during which Russia's share within natural gas imports reached 57%, posing a serious supply security risk in terms of the diversity of source countries. Reduction of this figure down to 33% in 2019 implies a new balance and the initiation of production in the discovered field will change this balance in favor of Turkey.
- Turkey has always aimed to be an energy hub. On the other hand, our country has not yet succeeded in transforming its advantage as a country located at the crossroads of pipelines (its "transit country" position) into an energy hub by supporting it with enriched financial resources and strengthened legal infrastructure. Extracting its own natural gas may prove to be an important step for being an energy hub for Turkey if it also fulfills other conditions.

2.3. YEKA and YEKDEM Developments

Failure to achieve targeted levels for the use of renewable energy resources and high initial investment costs paved the way for incentivizing these resources at a higher level. Major support mechanisms for renewable energy resources in Turkey are YEKDEM and YEKA. 2019 and 2020 saw considerable developments regarding both YEKDEM and YEKA.

2.3.1. YEKDEM Developments

YEKDEM is a mechanism backed by government guarantee for power plants aiming to generate electricity from renewable energy resources in the early 2000s. Built upon two main laws and various regulations, YEKDEM covers a USD-denominated feed-in-tariff under YEK for the first 10 years following the initiation of generation at renewable energy power plants. Furthermore, a domestic equipment incentive applies for the first 5 years in addition to the feed-in-tariff depending on the quantity and type of the domestic equipment used in the power plant. As mentioned in the "Electricity Outlook" and "Renewable Energy" sections of this report, as per the Resolution of the Council of Ministers No. 28842 of December 5, 2013, the period of benefiting from the prices listed in Schedules I and II attached to the YEK Law No. 5346 was extended from December 31, 2015 to December 31, 2020 for the owners of YEK-certified generation license subject to YEKDEM. Expectations regarding the announcement of a new mechanism prevailed in 2020, based on the information that YEKDEM, one of the major factors in the growth of the share of renewables in the electricity mix, would be terminated as of December 31, 2020.

Supply chain delays concerning renewable energy-based power plant investments with a high requirement for imported equipment triggered by the Covid-19 pandemic posed the risk of failure to fulfill the conditions of YEKDEM and renewable energy investments lagged behind their respective targets for 2020. In this respect, the sector expected an extension of time of 6-8 months since the pandemic constituted a force majeure. Published in the Official Gazette on September 18, 2020, the Presidential Resolution of September 17, 2020 stipulated that the YEK power plants subject to YEKDEM to be commissioned between January 1 and June 30, 2021 could benefit from the YEKDEM prices listed in Schedule I attached to the Law until December 31, 2030[32].

According to the resolution, the YEK power plants that are commissioned between January 1 and June 30, 2021 and file their applications to EMRA until October 31, 2021 can sell the electricity generated thereby between January 1, 2022 and December 31, 2030 over the YEKDEM prices. In line with the same resolution, equipment support will be added into the price of the electricity sold for five years from the date of commissioning of generation plants in the event that the mechanical and/or electro-mechanical equipment used in the YEK power plants to be commissioned between January 1 and June 30, 2021 are manufactured within the country. In 2020, 817 licensed power plants with a total installed capacity of 21,050 MW are currently covered by YEKDEM. If it is foreseen that a certain additional installed capacity will be covered by YEKDEM with the extension of time for six months, it is expected that the total installed capacity of YEK power plants that will benefit from YEKDEM after 2021 and 2022 will gradually decrease.

In an interview in June 2020, Minister of Energy and Natural Resources Fatih Dönmez stated that they would continue with a different system instead of the existing YEKDEM[33]. The details of this system were not disclosed for a long time while it was stated that YEKDEM would be implemented in Turkish lira and with an escalation system within the new system. Preliminary information on the new Turkish lira-denominated system announced during June for the first time was covered by the draft bill submitted to the Grand National Assembly of Turkey (GNAT) at the beginning of October.

Submitted to the Presidency of GNAT on October 5, 2020, the "Draft Bill Amending the Electricity Market Law and Certain Laws" stipulates that the YEK price can be set as Turkish lira. The firms generating electricity based on the renewable energy resources covered by the law and not wishing to be subject to the provision of this article can sell electricity in the free market under their licenses. Domestic contribution prices regarding the YEK-certified generation plants to be commissioned following June 30, 2021 as well as the unlicensed generation plants intended for meeting the needs of the consumption facility and the update of these prices, the duration of validity and matters on implementation can be set through a Presidential resolution[34].

2.3.2. YEKA Developments

It is envisaged that the YEKA tenders held since 2017 will continue to play an important role in the energy transformation of Turkey also following 2020. 3 out of 5 YEKA tenders, which were announced since 2017, were successfully completed for a total installed capacity of 3,000 MW and partial commissioning and construction phases are in place for the two of them. The first tender held in 2017 was YEKA SPP-1 tender awarded to the consortium of Kalyon and South Korean Hanwha. After Hanwha withdrew from the consortium in January 2019, Kalyon and CETC closed a deal for a 500-MW solar panel factory, which was commissioned in August 2020.

[32] Official Gazette, https://www.resmigazete.gov.tr/eskiler/2020/09/20200918-8.pdf
[33] https://ekonomi.haber7.com/ekonomi/haber/2989884-bakan-fatih-donmez-ilk-operasyon-temmuz-ayinda-basliyor/?detay=2
[34] https://www.aa.com.tr/tr/politika/enerji-alaninda-duzenlemeler-iceren-kanun-teklifi-tbmmde/1996417

In September 2020, 4 MW of the 1,000-MW SPP was commissioned and the SPP started generating electricity. The 1,000-MW YEKA WPP-1 tender held in 2017 was awarded to Siemens-Türkerler-Kalyon consortium. Siemens Gamesa Renewable Energy company started manufacturing nacelles in the newly-established company at the end of November 2019.

Pre-license application regarding the WPP planned to be constructed under this project was filed in November 2018. EMRA granted the company with a pre-license for two years effective from September 24, 2020[35]. It is planned to construct 6 WPPs within the scope of the project.

Table 15: WPPs with a Pre-License Under YEKA WPP-1

Name of the Power Plant	Starting Date	Date of Expiry	Installed Capacity (MW)
Gürün WPP	September 24, 2020	September 24, 2022	90
Kangal WPP	September 24, 2020	September 24, 2022	160
Sergen WPP	September 24, 2020	September 24, 2022	145
Balkaya WPP	September 24, 2020	September 24, 2022	260
Eskişehir WPP	September 24, 2020	September 24, 2022	50
Edirne WPP	September 24, 2020	September 24, 2022	295

Source: EMRA, TSKB

Two of the YEKA WPP-2 tenders completed in May 2018 with a total installed capacity of 1,000 MW were awarded to EnerjiSA while the remaining two were awarded to Enercon. On September 21, 2020, EnerjiSA announced that it agreed with 7 banks for financing the WPPs, each of which had an installed capacity of 250 MW and were planned to be built in Aydın and Çanakkale[36]. The financing to be extended under the "Sustainability-Associated Loan Agreement" is around EUR 650 million.

Following large-scale contests, the MENR announced that YEKA SPP-2 would be held in the form of small-scale projects. In this context, it was announced in November 2019 that there was a plan to announce mini YEKA SPP contests in December and receive bids in April[37]. Uncertainties triggered by the Covid-19 pandemic at the beginning of 2020 also affected the energy sector. Commenting on the mini YEKA SPP contests on March 9, 2020, Minister of Energy and Natural Resources Fatih Dönmez pointed out that preparations regarding the specifications and draft contracts were completed for the mini YEKA SPP contests. Stating that the call for content would be published in the Official Gazette, Minister Dönmez said that the first contest would take place in the first half of 2020[38].

Within the framework of all these developments, the call for mini YEKA SPP contests was published in the Official Gazette of July 3, 2020[39]. The call for contest stated that a total of 74 mini YEKA SPP contests based on solar power, each of which would have an installed capacity of 10 MW, 15 MW and 20 MW, would be held in 36 provinces, and applications for a total connection capacity of 1,000 MW would be filed between October 19-23, 2020.

Under the mini YEKA SPP, the ceiling price at baseline was set as 30 kurus /kWh for each contest and the duration for purchasing electricity energy was set as 15 years from the date of conclusion of the contracts.

[35] EMRA, http://lisans.epdk.gov.tr/epvys-web/faces/pages/lisans/elektrikUretimOnLisans/elektrikUretimOnLisansOzetSorgula.xhtml
[36] https://www.haberturk.com/enerjisa-ya-650-milyon-euro-kredi-2810416-ekonomi
[37] Solar Energy Investors Association, http://www.guyad.org/TR,445/guneste-mini-yeka-ihaleleri-aralikta-ilan-edecek.html
[38] MENR, https://enerji.gov.tr/haber-detay?id=596
[39] Official Gazette, https://www.resmigazete.gov.tr/ilanlar/eskiilanlar/2020/07/20200703-4-10.pdf

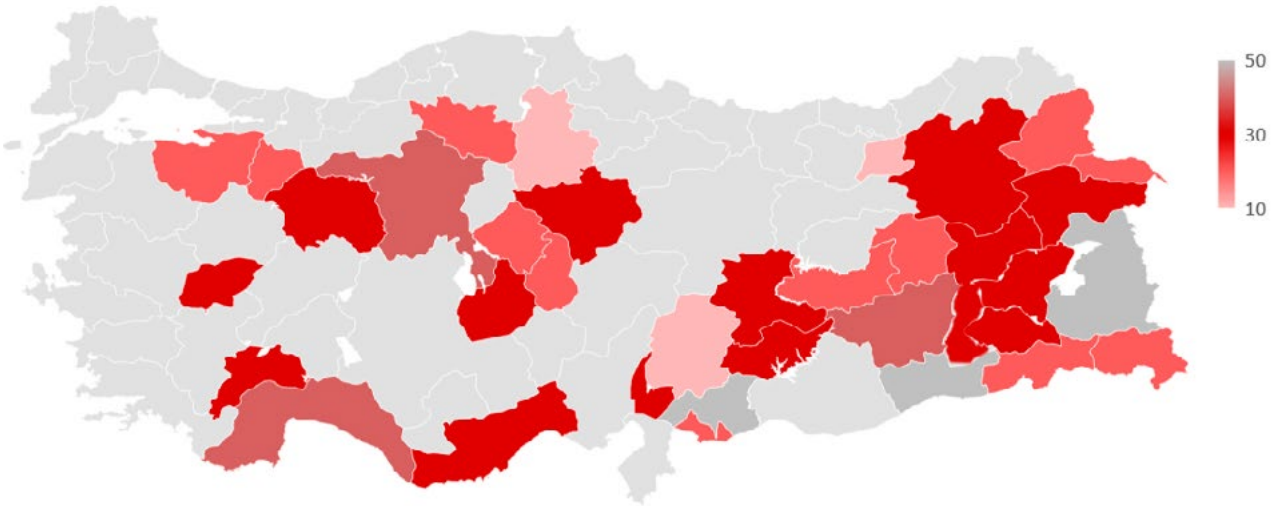
Table 16: Connection Capacity Under Mini YEKA SPP at Provincial Level

Connection Area	Connection Capacity (MW)	Connection Area	Connection Capacity (MW)	Connection Area	Connection Capacity (MW)
Adıyaman	30	Çankırı	20	Kilis	20
Ağrı	30	Çorum	10	Malatya	30
Aksaray	30	Diyarbakır	40	Mardin	50
Ankara	40	Elazığ	20	Mersin	30
Antalya	50	Erzurum	30	Muş	30
Batman	30	Eskişehir	30	Nevşehir	20
Bayburt	10	Gaziantep	50	Osmaniye	30
Bilecik	20	Hakkâri	20	Siirt	30
Bingöl	20	Iğdır	20	Şırnak	20
Bitlis	30	Kahramanmaraş	10	Uşak	30
Burdur	30	Kars	20	Van	50
Bursa	20	Kırşehir	20	Yozgat	30

Source: MENR, TSKB

In addition to all these developments, it was published in the Official Gazette with a correction notice on October 8, 2020 that the period of application for mini YEKA SPP contests previously announced as October 19-23, 2020 were postponed to January 18-22, 2021[40].

Figure 10: Breakdown of Mini YEKA SPP Connection Capacity



Source: MENR, TSKB

[40] Official Gazette, https://www.resmigazete.gov.tr/ilanlar/eskiilanlar/2020/10/20201008-4-8.pdf

2.4. Rooftop and Facade Solar Power Systems

Global climate change, population growth and increase in per capita energy consumption have more and more negative impacts on modern distribution networks, creating the need for finding alternative and clean energy sources, and, accordingly, adding more photovoltaic (PV) sources into the grid.

Defined as the electricity generation system aiming to generate electricity at or around the point of consumption, "distributed generation" has gained growing importance in recent years owing to the significant advantages it offers in environmental and efficiency areas when compared to the old "central generation" structure.

The risk of failure is reduced in distributed energy grids and the spread of power outages in an area to other areas is prevented via emerging technologies such as smart meters and small-scale battery storage systems.

Electricity generation from solar energy stands out particularly in modern distributed electricity grids, and apart from roof and facade applications, PV systems integrated into buildings are also present in developed countries.

Systems installed on the roof and on the facade of buildings or systems integrated into buildings are supported by state policies developed around the concept of "zero energy building" in the world and aiming for the highest energy efficiency.

As an example, for supportive incentives, many countries enable residential and commercial customers generating their own electricity from solar energy to sell the electricity they do not use back to the grid through "net-metering", and after the market reaches a certain maturity, they aim to incentivize energy efficiency by switching to the "self-consumption" model and raise the awareness of end consumers about this issue.

2.4.1. Rooftop and Facade-Type SPP in Turkey

Thanks to the mechanisms supporting renewable energy, the share of fossil fuel-based power plants in total electricity generation in our country decreased while the number of renewable energy-based power plants such as wind, solar, hydro and geothermal as well as their share in electricity supply increased rapidly. Then, in parallel with other countries with developed energy markets, steps were taken to increase the number of unlicensed power plants in particular, and various incentives were introduced with the amendments made in the Unlicensed Electricity Regulation in 2019.

Established within the framework of the Unlicensed Electricity Regulation, unlicensed SPPs are projects where consumption and generation are in the same place and "the excess consumption out of the energy generated is brought back to the grid through monthly net-metering" or "the entire energy generated is consumed via self-consumption". In this respect, both methods are expressed in the electricity market with the numbers of relevant articles (5.1.C and 5.1.Ç) in the Regulation.

Article 5.1.C of the Regulation on Unlicensed Electricity Generation in the Electricity Market

Important provisions under Article 5.1.C (monthly net-metering) of the Regulation are summarized below:

- *It only covers rooftop and facade applications (excluding the land).*
- *The point of generation and the point of consumption must be in the same place.*
- *There is an obligation of consumption.*
- *It is possible to install SPP at maximum contracted power.*
- *There is a 10-year feed-in-tariff (in return for the price of kWh purchased).*
- *Monthly net-metering (on the basis of kWh-kWh) is in place.*
- *There is a grid limit (grid fault current limit).*

Article 5.1.Ç of the Regulation on Unlicensed Electricity Generation in the Electricity Market

Important provisions under Article 5.1.Ç (self-consumption projects) of the Regulation are summarized below:

- *There is no upper limit of 5 MWe (the upper limit is equal to the contracted power).*
- *A distribution fee is charged for both supply and demand.*
- *It has the same application processes with unlicensed generation.*
- *The system can be installed on the land on the condition that generation and consumption are at the same point (except of OIZ area).*
- *The risk of not obtaining permission is low.*

Besides, important matters concerning unlicensed SPP applications for OIZ are summarized below:

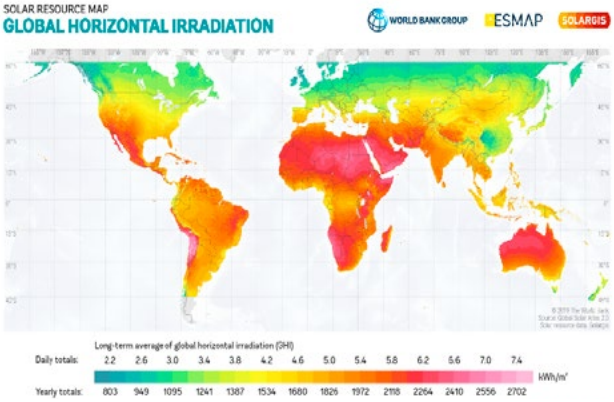
- *Both 5-1-C and 5-1-Ç apply to the places with a status of organized industrial zone.*
- *Only rooftop and facade applications are available (no land application).*
- *The point of establishing a generation plant and the point of consumption must be in the same place.*

Turkey stands out among other European countries in terms of sunshine duration and solar irradiance intensity. Countries within the "Sun Belt" covering a significant part of Turkey are considered as the best countries for benefiting from solar power. These regions cover the zone between 40° north and south latitudes of the Equator and stand out as the regions receiving the highest solar irradiance on daily and annual basis across the world. Although solar irradiance is high, these regions may technically lag behind the regions with a lower potential. Reasons such as temperature/humidity, distance to the Equator (seasonal variability), forest cover, agricultural lands, tourism regions and military zones may be decisive for this difference.

While analyzing the solar power potential of countries, a distinction is made between theoretical, technical and feasible potential. Theoretical potential considers the maximum possible application of a technology on the basis of total supply while technical potential is lower compared to the theoretical potential as it also takes potential limitations into account.

On the other hand, feasible potential considers technical restrictions as well as all legal conditions, economic and competitive areas of use.

Figure 11: Global Solar Radiation Per Square Meter



Source: World Bank, Esmap, Solargis

Considering the irradiation values of Germany, which is among the top 5 countries in terms of electricity generation from solar power and installed capacity, it is observed that the annual total of horizontal irradiance is between 1,000 and 1,300 kWh/m^2. These irradiance values correspond to lower values than even the most inefficient region of Turkey in terms of solar irradiance, the Black Sea Region. Similarly, irradiance values exceed 1,500 kWh/m^2 in a very limited area in Japan, which is among the top three countries in terms of solar installed capacity and solar electricity generation. In other regions, the irradiance value is in the range of 1,000-1,500 kWh/m^2. It is observed that annual irradiance values of Spain and Italy, which are located in the south of Europe and are among the top 10 countries in the world in terms of solar installed capacity, are in the range of 1,100-1,900 kWh/m^2.

These countries better use their irradiance potential through new investments. Accounting for about 35% of global solar installed capacity and around 31% of solar power-based electricity generation as of the end of 2019, China has more scattered irradiance values due to the size of its geography. Like other countries in the northern hemisphere, the annual irradiance values of the regions in the south of the country are around 2,200 kWh/m^2 while the irradiance values of the northern regions decrease to 1,200 kWh/m^2.

The MENR prepared Turkey Solar Energy Potential Atlas (SEPA) so as to identify best areas for solar power applications in Turkey and identify electricity or heat energy generation opportunities based on solar power in these areas.

According to the SEPA, the total annual sunshine duration is 2,741 hours over 7.5 hours in average per day while the total annual incoming solar energy is 1,527 kWh/m^2.year (daily average standing at 4.18 kWh m^2.day). Turkey hosts solar power potential for more than 110 days. Turkey's top solar power area is the Southeastern Anatolia Region, followed by the Mediterranean Region. These figures show that Turkey's solar energy potential is higher than many countries due to its geographical location.

There are provinces underusing their solar potential due to various reasons in our country as in the world. For instance, Antalya province has an annual average incoming solar energy (1,600 kWh/m^2) over Turkey's average level and has around 144 MW of unlicensed SPP capacity as of April 2020 while Ankara the annual irradiance value of which stands in the range of 1,400-1,550 kWh/m^2 hosts solar power plants with an installed capacity of 357 MW. Reasons such as the abundance of agricultural and tourism areas in Antalya province as well as climate conditions are decisive for this difference.

The state's encouraging stance towards the use of this solar potential is reflected in various official policy papers. The 2019-2023 Strategic Plan (Strategic Plan) published by the MENR on May 1, 2020 aims to increase the share of installed capacity of electricity based on domestic and renewable energy resources within total installed capacity from 59% to 65%. According to the Strategic Plan, the installed solar energy capacity standing at 5.75 GW in 2019 will increase to 10 GW in 2023.

2.4.2. Challenges Experienced in the Field of Legislation

Various challenges may be experienced regarding rooftop SPP investments in terms of legislation. These are grouped under challenges concerning regulations and legislation, technical challenges and environmental and social challenges.

Challenges Concerning Regulations and Legislation

- **High Distribution Fees Under Article 5.1.Ç**

The revision made in the Unlicensed Electricity Regulation of May 12, 2019 allows for the sale of surplus electricity generated within the installed capacity limited to 5 MW as per Article 5.1.C. Article 5.1.Ç regulates a high distribution fee even if monthly net-metering is allowed. It is observed that 5.1.C projects are preferred by companies in terms of price and feasibility advantage.

- **Ownership Problem of the Roof and Guarantees**

EPC companies can only sign a sales contract with the investor company that would like to install a rooftop SPP. No guarantee and/or alienation structure can be installed between the EPC company and the investor company as revenues will be generated out of the savings of the project.

There is no legal sanction even if the invoice is not paid. Since the investor company is a consumption subscriber, the meter cannot be blocked and/or its electricity cannot be cut off in any way. The requirement of preparing a standard legal agreement is discussed for this case. Besides, it is considered that the exemption of stamp duty concerning licensed projects is not valid for the agreements concluded with the sub-contractors of projects and a regulation must be issued in this area.

Technical Challenges

- **Challenges Experienced in the Commissioning of Power Plants**

During the process for the commissioning of rooftop SPPs, a local firefighting brigade requests escape points and wide escape stairs between panel rows in a project while another one may consider a much simpler staircase as sufficient. SPP projects are subject to the zoning permit and the approval and acceptance authorities are different. In rooftop SPP projects, preliminary acceptance is conducted by the affiliated branch of TEDAŞ while the project is approved by the distribution company in the region. A regulation must be issued in this regard.

- **Details of Technical Procedures and Principles During Commissioning**

In rooftop SPP projects, it is considered that bad installation risks, fire hazard, imbalances at the grid connection point, technical problems concerning the roof and resistance may occur. It is evaluated that investor companies should bring standards and certification for the related projects.

Environmental and Social Challenges

A certain period of time must be pass over the end of Covid-19 pandemic to reinvigorate the rooftop SPP sector. It is important that electricity generation and consumption levels affecting the feasibility reach the pre-pandemic levels. As the consumption decreased during the period in question due to the Covid-19 pandemic, the cost component of YEKDEM rose considerably as the tariff was calculated as MCP + YEKDEM price. Standing at TL 0.39-0.40 /kWh, the prices for OIZ rose to TL 0.53 /kWh.

2.4.3. Financing

There are many financing tools and policy mechanisms developed around the world for the implementation of rooftop SPP systems. Concessional loans, grants, risk-sharing mechanisms, consumer loans, insurance policies and leasing systems are considered as methods that can encourage investors.

The financing model based on the use of long-term loans extended by the banking system in Turkey will remain important. However, alternative financing models to existing financing models should be developed. Different investment scales and changing business models in renewable energy investments increase the need for new instruments. As a matter of fact, studies on the financing of rooftop systems by consumer finance institutions for the individual segment indicate that retail solutions may also come to the fore. There is a room for improvement for the models based on personal loans in addition to corporate and commercial loans for the financing of distributed systems. A lower risk triggered by personal loans will boost the interest of banks.

2.5. Hybrid Technologies

The hybrid technology with various examples around the world entered the agenda of the Turkish energy sector with the publication of the relevant regulation by EMRA on March 8, 2020. This section of the report examines hybrid technologies and power plants and shifts from global examples to Turkey by touching upon the legislation issued by the EMRA on hybrid investments and the financing thereof.

2.5.1 What are Hybrid Technology Plants?

Defined as "electricity generation plants based on more than one resource" by EMRA, "plants generating electricity based on a hybrid technology" cover combined renewable electricity generation plants, combined electricity generation plants, electricity generation plants with auxiliary resources and combined combustion electricity generation plants.

Hybrid technologies usually mean the combination of two or more power generation modes to provide electricity continuously or at critical moments. Combined renewable electricity generation plants represent a single power generation plant established to generate electricity from more than one fully-renewable energy resource that is connected to the grid from the same connection point while combined electricity generation plants refer to a single electricity generation plant established to generate electricity from more than one energy resource connected to the grid from the same connection point.

Considered as hybrid technology electricity generation plants, electricity generation plants with auxiliary resources are defined as a single electricity generation plant using another energy resource during the thermal transformation of generation plants.

Finally, combined combustion electricity generation plants are defined as a single generation plant combusting an auxiliary renewable resource in addition to the main resource in the same plant within the electricity generation plants using resources other than renewable energy resources[41].

2.5.2. Types of Hybrid Technology Power Plants

It is possible to use double or more renewable and thermal energy resources in hybrid technology power plants. According to the needs of the respective projects, these plants can be designed as on-grid, off-grid and green-line plants. Hybrid technology power plants involve the integration of conventional thermal power plants with renewable power plants or integration among renewable power plants in order to improve system efficiency and ensure energy supply balance as well.

2.5.2.1. Hybrid Thermal Power Plants

Thermal power plants (TPPs) whose operating costs have increased in recent years due to raw material costs are preferred less as they are also criticized due to the emissions of carbon dioxide and other gases. Benefiting from solar and/or wind power is considered as a window of opportunity for reducing internal consumption and operating costs for both coal-powered plants and natural gas power plants.

2.5.2.2. BPP+SPP/WPP

Biomass/biogas energy is the type of energy obtained as a result of incinerating or processing waste in different ways. Biomass can be transformed into various energy resources such as hydrogen, ethanol, methanol or methane by thermal, biological and physical processes with the administration of various techniques. Biogas technologies can be used to obtain liquid and gas fuel forms through the gasification and pyrolysis of biomass. Problems may be experienced in finding appropriate area as BPPs are generally established around agricultural lands. BPPs and WPPs can be operated in a hybrid way after the wind measurements of potential areas are performed.

2.5.2.3. WPP+SPP

WPPs generate more at night than daytime. SPPs are power plants that can generate during the day. Average capacity utilization ratios of such power plants are around 20%. However, wind speed is low during summer months when the sun's rays are strongest and brightest. The hybrid operation of these two technologies is common all over the world. The hybrid operation of WPPs and SPPs is an ideal example for two electricity resources, which can generate during different time periods, to complement each other. However, SPP installation as an auxiliary source to existing WPPs is considered as a faster and more effective option. In this case, one of the main constraints is the establishment of WPPs in forestlands and/or mountainous areas and the limited amount of land available in these areas.

[41] Official Gazette, https://www.resmigazete.gov.tr/eskiler/2020/03/20200308.pdf

2.5.2.4. Diesel Generator Systems

Diesel generators have been used as a source of electricity for years, especially in industrial establishments. However, companies now choose alternative energy sources due to the rise in fossil fuel prices over the years. Being one of the most common hybrid systems across the world and also known as the diesel generator system ("diesel genset"), PV diesel hybrid system is formed by combining PV panels with diesel generators. Diesel generators are used to fill the gap between demand and the electricity generated by PV systems.

2.5.2.5. GPP+SPP

GPPs are mainly located in Aegean Region in the west of Turkey. During the preparation of geothermal wells, the relevant well is surrounded for protection from external factors after drilling and piping works. Called as power plant areas, such areas are not used for any other purpose. GPPs are known as renewable power plants with the highest capacity factor. Although the internal consumption of GPPs is higher than other types of power plants, it varies between 10-20% and therefore it is the renewable energy source that needs auxiliary resources the most to meet its internal consumption.

2.5.2.6. HEPP+SPP

Reservoir HEPPs are constructed through the expropriation of very large areas. Therefore, their power plant areas are very large and no activity such as agricultural activity etc. is allowed in such areas. It is possible to implement hybrid technologies in these areas by installing both open field solar power plants and floating power plants over dam reservoirs. Since solar panels work more efficiently under cold weather conditions, the panels to be installed on the dam reservoir will be more efficient and will be able to retain the existing water in the lake by reducing evaporation as well. In this context, it is observed that the solar panels to be built over the reservoir will increase the efficiency of both the HEPP and SPP. Generating more electricity during spring months with the melting of snow when compared to other months, river-type HEPPs have lower electricity generation due to a decline in precipitation during summer months. SPPs can be a complementary technology to river-type HEPPs due to a rise in sunshine duration during summer.

2.5.2.7. Pumped Storage HEPP

Pumped storage HEPP (PHEPP) allow for the reduction of negative impacts on the grid depending on the rise of SPPs and WPPs, the storage of surplus energy in case of excess generation, the use of this energy for auxiliary services including voltage and frequency control for the grid operation, the storage of the energy generated by base load power plants at times when energy demand is low and the use thereof during peak hours.

PHEPPs are preferred owing to advantages such as large storage capacity and short activation time in spite of disadvantages such as high investment cost, high electricity consumption due to pumping and long construction period. PHEPPs use pumps and consume electricity to store water in their reservoirs. Used for pumping, this electricity can be generated within the plant via hybrid technologies.

2.5.3. Electricity Storage Systems

Considered as a complementary element of renewable hybrid technology power plants, electricity storage systems are used to eliminate seasonal, monthly and daily variation of the electricity generated by these resources. The existence of storage systems combined with hybrid technologies is of great importance to meet the electricity demand in all situations. Electricity storage systems also increase the potential to support the integration of renewable energy resources into the electricity grid[42].

2.5.4. Advantages and Disadvantages of Hybrid Technologies

It is possible to summarize the main advantages and disadvantages of hybrid technologies for both the existing power plants and new projects as follows:

2.5.4.1. Advantages of Hybrid Technologies

- Reducing the system imbalance in renewable power plants,
- Offering support to the plants that are no longer feasible and have difficulty in loan repayments,
- Off-grid operation (complete isolation from the system in rural areas owing to storage technologies),
- Utilization of idle lands within power plant areas and low investment cost,
- Efficiency improvement and contribution to the sustainability of energy.

2.5.4.2. Disadvantages of Hybrid Technologies

- A more complex system and operation,
- Difficulty of accurate generation planning,
- High investment cost if both components of the hybrid plants are greenfield investments.

2.5.5. Important Amendments to the Regulations on Hybrid Power Plants in Turkey

The first of the two new regulations allowing for the generation of electricity from more than one resource in the current and new licensed power plants to be established for the sector's needs was the "Regulation Amending the Electricity Market Licensing Regulation" published in the Official Gazette No. 31062 of March 8, 2020.

[42] Journal of the Faculty of Engineering and Architecture, Opportunities and Challenges for Energy Storage Applications in Smart Grids, (2017), https://dergipark.org.tr/tr/download/article-file/316477

The amendments introduced by this regulation are as follows:

- The auxiliary resource unit used within these plants can be used under a single pre-license or license as a unit of the plant based on the main resource (Article 5/1 of the Regulation),
- Installed capacities of the auxiliary resource and main source in these plants can be combined for a joint evaluation over the main resource so that the plants generating electricity based on more than one energy resource can be established on the condition that they are connected to the grid at the same connection point (Article 12/5-e, Article 20/6-e and Article 43/15 of the Regulation),
- Definition of floating SPP projects was also added into the legislation while these plants can now be installed on water surfaces within the areas of hydroelectric power plants with reservoir or regulator (Article 4/1-aaa),
- The auxiliary resource used in combined generation and combined renewable electricity generation plants cannot be transformed into the main resource in any way (Article 5/4 of the Regulation),
- No activity can be performed outside the field integrated into the pre-license. Besides, the plant's total installed electricity capacity, existing connection type, connection point and voltage level cannot be changed (Article 30/3 of the Regulation),
- The State Hydraulic Works (DSİ) must grant approval for the pre-license applications based on hydraulic resources (Article 12/6-c and Article 18/12-d of the Regulation).

Effective date of the said regulation was set as July 1, 2020.

Another important regulation issued by the EMRA was the "Procedures and Principles Regarding the Regulation of Power Plant Sites of Generation Plants Subject to Pre-Licenses or Licenses in the Electricity Market", which sets out the principles in identifying the project sites concerning the pre-license applications or available pre-licenses intended for establishing an electricity generation plant as well as the power plant sites concerning the plants covered by generation license applications or generation licenses. It entered into force upon publication in the Official Gazette of June 25, 2020.

2.5.6. Successful Countries with Hybrid Electricity Generation

As hybrid technologies represent a new development area, a complete legislative infrastructure for hybrid power plants is available in a very limited number of countries.

India is one of the pioneer countries in terms of hybrid power plants and stands out concerning the hybrid technology as regards both objectives and regulations. Since 2017, India has been implementing policies to support wind-solar hybrid technologies.

Following these framework policies, the country held the first tenders of wind-solar hybrid power plants announced to have a total installed capacity of 2.5 GW in 2018[43]. Intended uses of hybrid technologies vary depending on countries and regions. For example, on-grid/off-grid hybrid solutions are used to reduce dependency on diesel and improve the quality of electricity within the grid in Africa while the systems in Europe aim to increase the share of electricity generation based on renewables and improve predictability and efficiency.

2.5.7. Financing of Hybrid Technology Plants

In most of the countries that are relatively more advanced in hybrid technologies across the world, a model that will set an example for the conventional project financing model cannot be developed due to the execution of these investments with public stakeholders.

[43] Wind Power, https://www.windpowermonthly.com/article/1466024/india-auction-25gw-wind-solar-hybrids

2.5.7.1. Practices in Turkey and State of Play in Developed Markets

In Turkey, the Regulation on plants generating electricity based on hybrid technologies was published in March 2020 and EMRA started accepting license/pre-license applications or amendment applications from July 1, 2020. Hybrid investments in the sector are still at the beginning stage, and there are projects the EMRA application of which is pending and for which financing negotiations are going on within the framework of project finance.

2.5.7.2. Financing Mechanisms

Financing applications intended for investments in power plants based on hybrid technologies will be analyzed in the light of prospective cash flow assumptions and guarantee structure for the demand in addition to the credibility of sponsors. Therefore, the issue has been interpreted under the aforementioned titles within this report.

2.5.7.2.1. Cash Flow Assumptions

While performing a finance assessment concerning a new investment in an operational power plant, potential additional income by the new investment in addition to the cash flow generated by the project's main generation resource and the cost of this additional investment will be compared. An important difference in terms of the investment amount is that the investment cost per MW is lower than that of a power plant based on the same resource installed elsewhere as a single power plant due to the use of common energy transmission lines and substation. On the other hand, the unit to be installed for the resource to be used as auxiliary power might not be located at optimum coordinates when compared to a greenfield power plant on solar and wind side as such power plants must be located within the land of the power plant based on the existing main resource as per the Procedures and Principles of June 25, 2020, which may decrease expectations concerning the generation amount. One of the most critical issues in the evaluation of financing requests will be the time remaining until the deadline for the use of YEKDEM in terms of facilities that are currently operational and, additionally, the time remaining until the end of initial 5 years with regard to the projects receiving domestic contribution support.

2.5.7.2.2. Guarantee

Long-term loans used for power plant investments are allocated for repayment with the revenues to be generated from the sales of the relevant power plants to EXIST or to third parties through bilateral agreements. In this sense, the most critical collateral in financing energy generation investments is the assignment of the electricity sales amounts to the lending bank.

If the power plant based on the existing main resource is transformed into a hybrid facility with an auxiliary resource, the quantity of electricity to be supplied to the system will increase and the resources will be monitored as a single resource in the system over the same PK Code since both resources are connected to the system at the same grid point. Therefore, when the lender finances the auxiliary resource-based power plant to be commissioned with an additional investment in an existing facility, scope of the existing assignment agreement will be extended. If an existing plant is transformed into a hybrid plant, no obstacle is present concerning the establishment of conventional project collaterals in general. In the event that the hybrid plant is a greenfield investment in terms of both the main resource and auxiliary resource, all project collaterals will be established in an integrated way for all rights, assets, machinery & equipment and lands of both plants.

2.6. Battery Storage Systems

Connection capacity of renewables proves to be limited due to their intermittent and irregular nature, negative impact on the electricity grid and low availability. An important solution to this significant problem is energy storage. Storing surplus energy out of electricity generation and feeding it back to the grid at times of intermittent and irregular electricity generation enables continuous energy supply and increases the efficiency of existing resources.

Different types of energy storage technologies (mechanical, thermochemical, chemical, electrical and electrochemical) have been theoretically developed from the past to the present, but very few of these technologies have been commercially available to a large extent. Among these technologies, especially electrochemical (battery) energy storage systems stand out as a trend today. Battery-based energy storage systems include different battery technologies - lead-acid, lithium ion (li-ion), zinc-hybrid (Zn-hybrid), sodium-sulfur (NaS) and redox (flow) - while li-ion type comes to the fore in terms of the number of global uses and completed reference projects. The main reasons for this phenomenon are that the type of battery used in the automotive industry is also li-ion and the unit production costs of such batteries tend to decrease with the rising manufacturing capacity.

The downward trend in the costs of batteries and other system components and the auxiliary function of the battery-based energy storage systems in the electricity grid will significantly increase the use of such storage systems in the near future.

2.6.1. Classification of Battery-Based Energy Storage Systems

Battery systems are one of the oldest methods of storing electrical energy in chemical form and are basically systems that generate electricity by chemical reaction.

Battery systems are divided into two categories as non-rechargeable (primary) batteries and rechargeable (secondary) batteries. Primary batteries contain chemicals such as zinc-carbon, zinc-chloride, alkali-manganese, zinc-air, silver-zinc, lithium-based batteries, etc. while secondary batteries contain chemicals such as lead acid, nickel-cadmium, nickel metal hydride, li-ion, etc. An analysis of the market share of the different battery types in use shows that the market share of li-ion batteries is constantly increasing.

2.6.1.1. Lead Acid Batteries

It is the oldest and most mature battery technology. The battery consists of a lead (Pb) cathode, a lead dioxide (PbO_2) anode and sulfuric acid (H_2SO_4) electrolyte as the chemical medium. The most common field of use is starter batteries in vehicles. Lead carbon electrode batteries have advantages such as low charging voltage, short charging time, less corrosion on plates and the high number of cycles. Lead acid batteries are heavy with a low energy capacity although they constitute a well-known technology and they are low-priced.

2.6.1.2. Flow (Redox) Batteries

Flow battery systems have high energy density. These systems represent a battery technology under development. There are several types of flow batteries: iron-chromium (Fe-Cr), iron-vanadium (Fe-V), zinc-bromide (Zn-Br_2), zinc-chloride (Zn-Cl_2) and hybrid flow systems. Power and energy flow are separate in such batteries. The following table lists major redox (flow) battery manufacturers.

Table 17: Redox (Flow) Battery Manufacturers

Redox Battery Technology	Manufacturers
Vanadium Redox Batteries	American Vanadium, Imergy, UET/UniEnergy, Vionx
Zinc Redox Batteries	Enphase (Previously ZBB), Primus Power Flow, RedFlow

Source: DNV GL Energy Storage with Battery Study (2017)

Advantages and disadvantages of redox (flow) batteries are summarized in the table below.

Table 18: Advantages and Disadvantages of Redox (Flow) Batteries

Advantages	Disadvantages
Scalable for large applications	More complicated than conventional batteries
Longer life in deep cycling	An early stage of development
Long cycle life (more than 10,000 full cycles)	High-cost vanadium and current membrane designs

Source: World Energy Council, Five Steps to Energy Storage (2020)

2.6.1.3. Sodium Sulfur Batteries (NaS)

A NaS battery is made of liquid salt sodium (Na) and sulfur (S). NaS batteries are a type of molten-salt battery. Such batteries have high energy density, fast response time and long cycle life. In addition, this battery type has the longest lifetime in the market. NaS batteries store electricity through a chemical reaction running at 300°C or higher. At lower temperatures, chemicals solidify and no reaction occurs. The prominent company in NaS battery production is NGK (Noritake's Insulator Division). Advantages and disadvantages of NaS batteries are summarized in Table 19.

Table 19: Advantages and Disadvantages of NaS Batteries

Advantages	Disadvantages
High energy density	Need for thermal management
High charging and discharging efficiency	Thermal self-discharge, limitation of parking time
Long cycle life	Safety concerns due to the reaction of sodium and sulfur

Source: World Energy Council, Five Steps to Energy Storage (2020)

2.6.1.4. Lithium Ion Batteries (Li-ion)

The first commercial li-ion rechargeable battery was produced in 1991. It is widely used in portable devices due to its high energy density and negligible self-discharge. Li-ion batteries vary in terms of the chemicals used in them. Three of the most important and promising chemicals stand out as Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_2$ or NCM), Lithium Iron Phosphate ($LiFePO_4$) and Lithium Titanate ($Li_4Ti_5O_{12}$ or LTO). The prominent and market-tested manufacturers out of these different li-ion battery technology manufacturers are given in Table 20 below.

Table 20: Li-ion Battery Manufacturers

Li-ion Technology	Manufacturers
Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_2$ or NCM)	Enerdel, Hitachi, LeClanche, LG Chem, Panasonic, PBES, Samsung, XALT, Electronova
Lithium Iron Phosphate ($LiFePO_4$)	A123, BYD, K2 Energy, Microvast, Saft, Sony, Thundersky, XO Genesis
Lithium Titanate ($Li_4Ti_5O_{12}$ or LTO)	Altainano, LeClanche, Microvast, Toshiba, XALT

Source: DNV GL Energy Storage with Battery Study (2017)

Advantages and disadvantages of li-ion batteries are summarized in the table below.

Table 21: Advantages and Disadvantages of Li-ion Batteries

Advantages	Disadvantages
Very high energy density	Extreme reactivity and flammability
Low maintenance	Requirement of recycling programs and safety
Relatively low self-discharge	Ageing effect
High rated voltage	Natural deterioration

Source: World Energy Council, Five Steps to Energy Storage (2020)

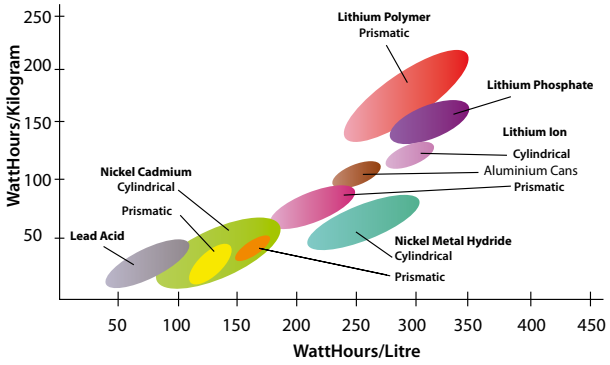
2.6.2. Comparison of Battery Technologies

It is necessary to analyze different battery technologies in detail in terms of price, performance and stability and use the product meeting the respective needs. Batteries such as Li-ion, NaS and nickel-cadmium (NiCd) are used in applications requiring high power demand and power density. Among these battery technologies, it is predicted that Li-ion will have great potential in terms of development and stability in the future. Besides being small in size and weight, Li-ion batteries offer nearly 100% storage capacity and high energy density.

In order to compare battery storage systems, a few technical definitions are needed in the first place.

- Cycle Life: The number of charge/discharge cycles before a battery loses its performance significantly.
- Deep Cycle: Discharge of 80% or more of a battery. It shortens the lifetime.
- Round-Trip Efficiency: The ratio of the energy put into the energy retrieved from a battery during a cycle.
- Energy Density: The amount of energy that can be stored per weight (kW per kg) within the unit of a single system.
- Lifetime: The total time during which an energy storage device can remain in use.

Chart 26: Comparison of the Gravimetric and Volumetric Energy Densities of Battery Technologies



Source: Electropaedia, https://www.mpoweruk.com/chemistries.htm

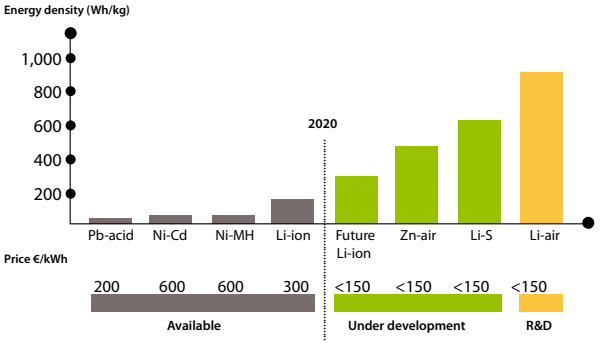
Gravimetric and volumetric comparison of the energy densities of the battery technologies described above is presented in Chart 26. As can be seen from the figure, li-ion batteries offer higher energy density.

2.6.3. Costs and Trends

It is predicted that battery costs will continue to decrease depending on the respective battery technology in the medium and long term. The costs of battery-based energy storage systems are typically given per kW and kWh. If the cost components of a water tank and a battery-based energy storage system are compared, the tank size (lt) is similar to the energy (kWh) while the flow rate (lt/hour) corresponds to the power (kW). A battery-based energy storage system consists of different main components:

- A container encompassing the batteries (series connection) and the battery system,
- Battery management automation,
- Direct current side switches and wiring and bidirectional inverters,
- Alternating current side wiring and transformer,
- An energy management system ensuring automation with the electricity grid,
- A remote control and monitoring system,
- A heating, cooling and fire-fighting system.

Chart 27: Comparison of Energy Density and Price for Battery Technologies



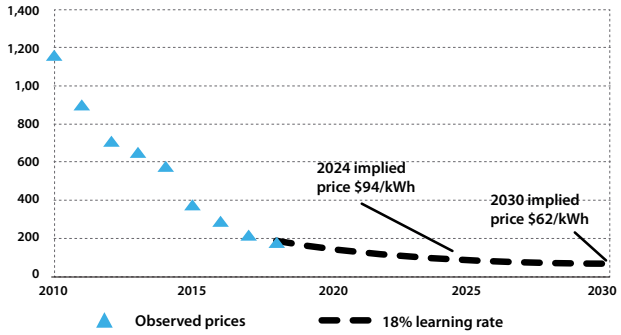
Li-air = lithium-air, Li-ion = lithium ion, Li-S = lithium – sulfur, Ni-Cd = Nickel-cadmium, Ni-MH = nickel-metal hydride, Pd-acid = lead-acid, Zn-air = zinc-air.

Source: Asian Development Bank, Handbook on Battery Energy Storage System (2018)

Technological changes in batteries are moving towards higher energy density, and owing to new-generation battery technologies (Li-ion, zinc-air, lithium-sulfur, lithium-air, etc.) it is expected that the energy density of secondary (rechargeable) lithium batteries will be improved and the price per kW will go below USD 50.

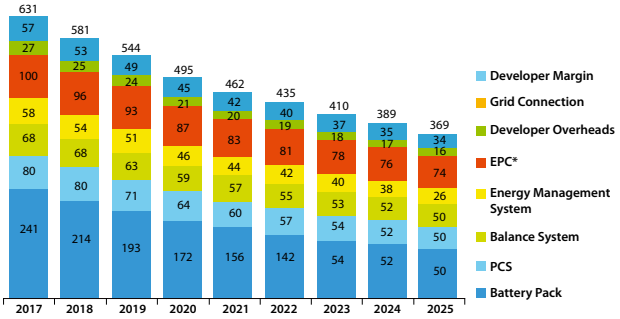
Considering the prices of the li-ion battery technology in 2018 as well as the downward trend in costs, a projection has been created for upcoming years and it is estimated that the price will drop to around USD 62 /kWh by 2030. The relevant projection is presented in Chart 28.

Chart 28: Lithium-Ion Battery Price Projection (USD/kWh in 2018)



Source: Bloomberg, New Energy Finance (2019)

Chart 29: Comparison of Price Components in Battery Technologies



Source: Asian Development Bank, Handbook on Battery Energy Storage System (2018)

For a battery-based energy storage system with the same capacity, engineering, procurement and consulting contract (EPC) costs also decrease in parallel with battery costs. Price projection for all installation costs of a battery-based energy storage system is shown in Chart 29 above.

2.6.4. Current Developments in Our Country

Continuous growth and developments are in place for battery storage technologies. It is of importance that Turkey follows such technologies closely and the research & development efforts of the public and private sector be supported. The regulations issued in our country consider energy storage facilities as an auxiliary service unit for the first time.

Introduced by the MENR from April 1, 2020, the "Regulation on the Acceptance of Electricity Generation and Storage Facilities" aims to ensure the execution of acceptance procedures for electricity storage facilities as per the relevant legislation and standards. "The Draft Regulation on Electricity Storage Activities" was published by the MENR with regard to electricity storage activities on January 4, 2019 and opinions were received concerning the draft. The final legislation is pending.

The new YEKA tender for solar power planned to be held in January 2019, but later be canceled envisaged the installation of a battery storage system and the technical characteristics and performance criteria expected from this system were announced through the tender specifications. Feedback was provided for these tender conditions examined by the private sector and relevant stakeholders. In the light of these studies, it is expected that tenders for such battery storage systems will be held again in the near future.

2.6.5. Conclusions and SWOT Analysis

It is predicted that the electricity energy to be generated out of solar and wind power in the world will meet 63% of the total global demand by 2050. The International Renewable Energy Agency predicts that the upward trend of battery storage systems to be connected to the grid will continue, with an estimated average decrease of 60% in battery storage technology costs between 2016 and 2030.

Considering the rise in the installed capacity of wind and solar power and the projections for the number of electric vehicles in the future, the importance of investing in battery storage technologies that will bring more flexibility to the electricity grid will be better understood.

Table 22: SWOT Analysis for Battery-Based Electricity Storage Systems

Strengths	Weaknesses	Opportunities	Threats
Reduction of load and demand on the electricity grid	Lack of necessary legislation and technical standards	Advanced frequency management on the grid	Problems in the procurement of storage materials
Rapid decrease in battery and installation costs	Relatively high costs	Market capacity	Problems in the supply of mines
Support for grid stability	Complex revenue and business model structure	Ability to benefit from different electricity tariff periods	Possibility of legislative amendments
Integration of renewable power plants	Infrastructure deficiencies in terms of application	Improvement of the operation and capacity of the grid	The fact that the technology is not saturated yet
Impact on technology diversity and development	Lack of know-how, domestic resources and equipment	Growth in the share of renewables	

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2.7. Electric Vehicles: Developments in Turkey

In order to pass on a sustainable future to the next generations, it is important to use clean technologies in the automotive sector, as in all other sectors, and to support technologies that will contribute to increasing energy efficiency and reducing emissions and carbon emissions. In the face of the critical level of global warming and the increasing environmental, social and economic costs, the automotive sector, like many other sectors, has entered into an irreversible transformation process. Because, road transport accounts for about 16% of human-induced carbon dioxide emissions[44]. Out of the measures that can save the world from dependence on fossil fuels, electric vehicles are gaining importance. With around 1,000 electric vehicles in use, Turkey has just begun to develop its own market. However, there is a significant potential for the rise in the use of electric vehicles with the increase in vehicle ownership and the growth of population. In addition, Turkey has initiated manufacturing its own domestic electric vehicle.

This will pave the way for the improvement of local air quality in cities and the reduction of carbon dioxide emissions based on the generation and consumption of energy in both the transport and electricity sectors owing the electricity generated based on renewables.

[44] International Organization of Motor Vehicle Manufacturers (OICA). http://www.oica.net/category/climate-change-and-co2/

2.7.1. Turkish Electric and Hybrid Vehicle Market

An analysis of electric vehicle sales in Turkey by years shows an upward trend for sales except for 2016. A total of 878 electric vehicles were sold from 2015 to September 2020. Renault, BMW, Jaguar, Mini Cooper and Smart account for electric vehicle sales by 31%, 29%, 25%, 9% and 7%, respectively.

Table 23: Development of Electric Vehicle Sales in Turkey by Brand

Turkey Electric Car Sales (Units)	Segment	2015	2016	2017	2018	2019	2020/9	Total
BMW i3	C2	83	24	35	37	50	23	**252**
Jaguar I-Pace	E7	-	-	-	38	119	60	**217**
Mini Cooper SE	B2	-	-	-	-	-	76	**76**
Renault Zoe	B2	36	20	42	79	31	60	**268**
Smart EQ	A6	-	-	-	1	22	42	**65**
Total		**119**	**44**	**77**	**155**	**222**	**261**	**878**

Source: Turkey Electric & Hybrid Vehicles Association, TSKB

Global electric vehicle sales are on the rise owing to the policies addressing the development of different types of electric vehicles and the rollout of charging infrastructure. By the end of 2018, the total number of electric vehicles in the global vehicle stock exceeded 5 million. A similar number of charging stations are operational for meeting the electricity demand of electric vehicles[45].

Table 24: Development of the Turkish Automobile Market and Electric-Hybrid Automobile Sales

	2015	2016	2017	2018	2019	2019/9	2020/9
Turkey Automobile Market	725,596	756,938	722,759	486,321	387,256	228,628	388,690
Electric and Hybrid Cars Market	1,094	1,082	4,582	4,054	12,196	7,775	12,011
Electric and Hybrid Vehicle / Automobile Market (%)	0.2	0.1	0.6	0.8	3.1	3.4	3.1
Automobile Market Annual Change (%)		4.3	-4.5	-32.7	-20.4		70.0
Electric and Hybrid Automobile Market Annual Change (%)		-1.1	323.5	-11.5	200.8		54.5

Source: Automotive Distributers' Association Press Release

[45] Shura Energy Transition Center, Transport Sector Transformation: Integrating Electric Vehicles Into Turkey's Distribution Grids, 2019, https://www.shura.org.tr/wp-content/uploads/2019/12/Turkiye-ulastirma-sektorunun-donusumu-Elektrikli-araclar%C4%B1n-Turkiye-dagitim-sebekesine-etkileri-.pdf

2.7.2. Turkey's Automobile Joint Venture (TOGG)

TOGG was established on June 25, 2018 by Anadolu Group (19%), BMC (19%), Kök Group (19%), Turkcell (19%), Zorlu (19%) and the Union of Chambers and Commodity Exchanges of Turkey (5%) in order to create a globally-competitive automobile brand. Foundations of the factory in Gemlik with an indoor area of 230,000 square meters over a land of 1.2 million square meters were laid on July 18, 2020. It is planned that orders be placed for the equipment during the last quarter of 2020 and lines be installed during the 3rd quarter of 2021.

The factory investment is estimated to be TL 22 billion. It was announced that the first production process would be completed in 18 months and the first native electric, connected and autonomous C-segment SUV (sport utility vehicle) would be manufactured with TOGG brand by the end of 2022. SUV and saloon-car models were promoted at the Informatics Valley on December 27, 2019. It was stated that the annual manufacturing capacity of the factory would be 175,000 units and a total of 1 million vehicles in 5 different models (C segment SUV-date of release: 2022, C segment saloon-car-date of release: 2024, C segment hatchback-date of release to be announced, B segment SUV-date of release to be announced and S segment MPV-date of release to be announced) would be manufactured within 10 years. It was indicated that the target with regard to the manufacturing of Turkey's domestic automobile TOGG was to achieve a minimum domestic production share of 51% and 68% by 2022 and following 2025, respectively.

With regard to the suppliers playing a very important role in vehicle production, TOGG announced that they closed a deal with the Chinese battery manufacturer Farasis in October 2020. According to the deal, Farasis firm will supply the li-ion batteries to be used in the electric vehicles developed by TOGG. Offering battery configuration options with a range of 300 km or 500 km, the automobile will be charged at home, in the office or at road-side stations and its battery will be charged by 80% in less than 30 minutes owing to the quick charging capability. A battery warrant period of 8 years will be granted.

It is predicted that the lean technical infrastructure of electric and connected automobiles, the possibility of updating their software over the internet and the capability of warning users on technical issues through preventive information will minimize technical service/maintenance requirement and keep energy cost per kilometer lower than the automobiles with internal combustion engines.

2.7.3. Obstacles in the Turkish Electric Vehicle Market and the Actions to Be Taken

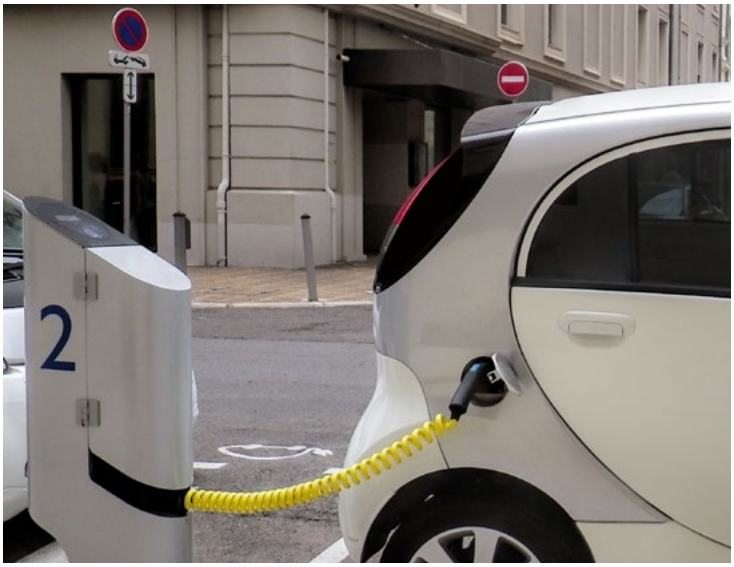
There are important steps to be taken by Turkey regarding its electric vehicle market and applicable regulations are required. Considering the practices of EU member states regarding electric and hybrid vehicles within the EU, the following regulations and practices draw attention[46].

The "Alternative Fuels Infrastructure Directive (2014/94/EU)" emphasizes that one charging station must be available per 10 electric vehicles and the location information of such charging stations must be more accessible in order to establish an appropriate charging infrastructure for electric vehicles across the EU. Besides, provisions for the standardization of technical specifications are also defined. It is also stated that the charging stations must make use of intelligent metering systems recharging batteries from electricity grids at times of low general electricity demand. This paves the way for smart systems enabling the batteries of electric vehicles to feed back to the grid in the long run.

[46] TEHAD, Electric and Hybrid Vehicles Magazine, April 2020

Through the "Commission Delegated Regulation as regards the Acoustic Vehicle Alerting System", the EU stipulates that a sound-emitting device must be installed in all new electric vehicles from July 1, 2021 since the silent operation of electric vehicles poses a risk for the safety of the pedestrians and drivers not acquainted with such vehicles.

Under the "Directive on the Energy Performance of Buildings (2018/844)", all new non-residential buildings and/or non-residential buildings undergoing major renovation, with more than 10 parking spaces, must have at least one recharging point for electric vehicles in EU member states. The "Clean Vehicles Directive (2009/33)" was revisited in 2019. This directive aims to increase demand for low-emission vehicles by offering some incentives under public tenders.



There are many "Financial Support Programs" within the EU for the cumbersome electromobility transformation. It is observed that financial support funds are primarily intended for charging station infrastructures, the procurement of electric buses and innovation studies.

Leading the world motor vehicle production with a share of 30%[47] and turning into the most important electric vehicle market with a sales figure of 352,000 units in 2016, China introduced an obligation to allocate at least 10% of production units to electric vehicles from 2019 for all automotive manufacturers the annual production of which surpassed 30,000 units. It is predicted that this new regulation introduced by China will force the major players of the industry to take a more aggressive stance in the electric vehicle segment.

In Europe, the main export market of Turkey, the UK and France have already approved the prohibition of all gasoline and diesel-powered vehicles from 2040 and the Netherlands from 2025. In addition, many countries such as Austria, Denmark, Ireland and Portugal have set various intermediate targets for electric vehicles. These countries have introduced strict emission controls, restricted the entry of other vehicles into city centers and implemented differentiated tax and fee policies for electric vehicles. Answers to the following questions regarding electric vehicles and hybrid vehicles in Turkey are of importance for the use of electric vehicles.

1. What are the sales price ranges of electric vehicles and hybrid vehicles?
2. How many kilometers can be traveled with a single charge?
3. How long does the battery take to recharge?
4. What are the locations of the charging stations?

The most preferred model regarding electric vehicles is the Renault Zoe model and its list price is TL 372,900 as of October 27, 2020. The most preferred models among hybrid vehicles are New Toyota Corolla and Toyota C-HR models, and as of October 27, 2020, the list price of New Toyota Corolla is in the range of TL 317,250-TL 367,050 (the list price of the non-hybrid model is between TL 224,200-TL 307,000), the list price of Toyota C-HR with SCT incentive is in the range of TL 238,250-TL 328,550. It is observed that the prices of hybrid vehicles are still high although an SCT incentive is in place. The frequency of recharging electric vehicles varies depending on the distance covered and the battery capacity. The average range of an electric passenger vehicle is currently around 200 km and it is expected that this range will be extended through the developments in battery technology.

[47] European Automobile Manufacturers Association, The Automobile Industry Pocket Guide 2017-18

The battery can be fully charged in fast recharging stations within 1-1.5 hours. All charging station brands share the maps of their stations on their pages. As the number of these stations continues to rise, electric vehicles will be used more commonly. Turkey Electric & Hybrid Vehicles Association (TEHAD) organized the Workshop on Turkey's 2030 Roadmap for Electric Transport in February 2020. 5 main themes of the workshop are as follows:

i) car batteries and battery technologies and electricity storage;
ii) digitalization and consumers' habits of use;
iii) grid infrastructure;
iv) automotive supply industries and after-sales services;
v) charging stations.

Current obstacles regarding the main themes were identified and the short-medium and long-term actions were set. It was stated that the contributions of TEHAD, TÜBİTAK (Scientific and Technological Research Council of Turkey), universities, original equipment manufacturers, the Ministry of Industry and Technology, the Ministry of Environment and Urbanization, battery manufacturers, vehicle manufacturers, the Small and Medium-Sized Enterprises Development and Support Organization, supply industry manufacturers, insurance companies, EMRA, distribution companies, charging operators, energy generation firms, local governments, municipalities and TOGG were required for taking necessary steps.

The IEA predicts that 56 million electric vehicles will be on the roads across the world by 2030[48]. McKinsey estimates that 10-50% of the vehicles sold around the world will be electric vehicles by 2030 while PriceWaterHouseCoopers predicts that 55% of the new vehicles sold across the globe will be electric vehicles by 2030. Published by Bloomberg New Energy Finance, "Long-Term Electric Vehicle Outlook" report states that the electric automobile market will shrink by 18% in 2020 due to the Covid-19 pandemic and this drop will materialize at 22% for the automobiles with internal combustion engines. It is also noted that 58% of all new passenger automobiles sold around the world in 2040 will be electric vehicles and the share of electric vehicles in the entire vehicle fleet will be 31%[49]. Announced in 2015 and signed by 175 countries in April 2016, the Paris Agreement on Climate Change sets the target of limiting the increase in global average temperature between 2 and 1.5°C above pre-industrial levels by 2100[50].

According to the IEA, 600 million electric vehicles must be used by 2040 in order to achieve the target set in the Paris Agreement on Climate Change. Major topics discussed in our country with regard to the electric vehicles that are of quite importance at global level are as follows: High costs regarding car battery and battery technologies and electricity storage, long recharging times, the grids that are not fully ready for any potential demand rise, the failure to ensure integration with gas station networks, the high cost of owning an electric vehicle, the assumption that the range is not enough and the incompatibility of after-sales services with CASE[51] (Connected-Autonomous-Shared-Electric).

The priority steps to be taken in this regard are improving knowledge, offering incentives, developing range-expanding solutions, organizing events such as driving and seminars to eliminate safety concerns, enforcing the Carpark Regulation for all buildings, drawing up an action plan for CASE after-sales services for original equipment manufacturers and establishing after-sales electric vehicle service & maintenance centers.

[48] IEA, Global Electric Vehicles Outlook (2017)
[49] TEHAD, http://tehad.org/2020/05/21/uzun-vadeli-elektrikli-arac-gorunum-raporu-yayinlandi/
[50] IEA, Global Electric Vehicles Outlook, 2017.
[51] CASE: Connected – Autonomous – Shared - Electric

2.8. Emissions, Climate Actions and Turkish Energy Sector

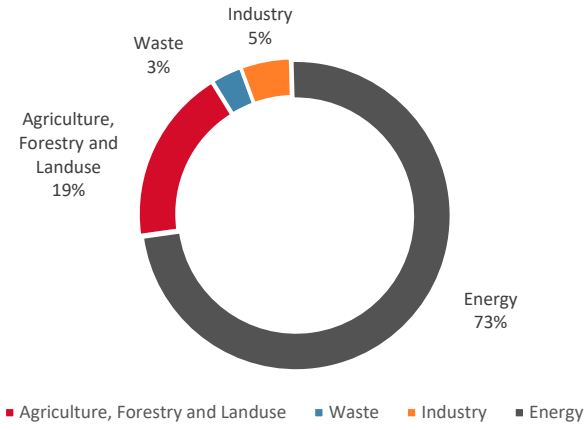
Although climate change is not spreading as fast as the Covid-19 crisis bitterly exposing how unprepared the world is against a global crisis, it is a problem for humankind with much more serious consequences. Scientific warnings have been made for long years, but unfortunately, not enough progress has been made regarding effective action. Studies estimate that temperatures will rise by 4°C in 2100 above pre-industrial levels.

It is predicted that in case of even a temperature rise of 1.5°C, average annual draught period will be extended by 2 months, the number of people to experience water scarcity across the world will reach 271 million people, the areas burnt due to forest fires in the Mediterranean will rise by 41%, the frequency of extreme precipitation will increase by 17%, the losses arising out of annual flood disasters will surpass USD 10.2 trillion due to a rise of the sea level, global GDP will shrink by 8% until 2100, the geographical areas with a potential for the contagion of malaria will be expanded by 19% and the possibility of unprecedented summer temperatures in Europe will rise by 47%. It is stated that such impacts will be felt in a much more severe way in case of a rise at or over 2°C. This means that a temperature rise of 4°C will cause irreversible devastating effects on the world.

There is a risk of climate change impacts spreading from one sector to another, and these impacts have the potential to seriously threaten not only daily life but also business life and public activities.

Climate change is responsible for the frequent extreme weather events, flood disasters, torrential rains, large hailstorms and temperatures that exceed seasonal normal in recent years and break new records in recent years.

Chart 30: Sectoral Breakdown of Global Greenhouse Gas Emissions



Source: Our World in Data, TSKB

It is possible that large migration waves will start in many island states and coastal countries in the south Asia-Pacific region in particular with the melting of glaciers in polar zones and the gradual rising of sea levels triggered by the climate change. Studies also reveal the devastating impacts of the climate on biodiversity[52]. If the carbon emissions paving the way for the climate change are not forestalled in an immediate way, the emergence of pandemics such as the Covid-19 will also gain momentum. Unavoidable water scarcity will be one of the most devastating impacts of climate change. Today, two-thirds of global greenhouse gas emissions originate from the energy generation used for heating, electricity, transport and industry. About half of the carbon emissions arising out of energy use occur due to the energy used in industry.

The remainder is split roughly equally between the transport sectors and energy use in buildings. Dependent on fossil fuels, the world economy has decreased its dependence to a certain extent with the increasing share of renewables in global energy supply. However, fossil fuels still hold a very important share in the global energy supply. The initial investment costs for renewable energy resources, which have emerged as an alternative to fossil fuels, have been declining thanks to technological developments. Although the share of renewables in the global energy system increases each day, the current level of progress is not sufficient to curb the pace of climate change and global warming.

Developed countries such as the USA and some EU countries generated greenhouse gas emissions after the industrial revolution[53]. However, it is currently observed that the distribution of greenhouse gas emissions has changed due to the displacement of industry and production-based emissions, differing development policies and new studies. An analysis for the distribution of recent greenhouse gas emissions shows that the largest share belongs to China. China is followed by the USA, India, Russia and Indonesia[54]. This distribution reveals that emissions are shifting towards developing countries. There are significant differences between developed and developing countries in terms of basic indicators such as energy consumption per capita, energy intensity which is an indicator of energy efficiency, and the carbon intensity of energy supply.

Although the energy demand dropped in an inevitable way at the beginning of 2020 during which industry, accommodation, entertainment, sport, transport and tourism etc. sectors were deeply affected and their activities were slowed down or completely suspended due to the Covid-19 pandemic, it is considered that the energy demand will rise at a decreasing pace depending on different variables such as population growth and urbanization upon the post-pandemic recovery of the global economy. The increase in demand brings about the transformation of the energy sector, triggering the establishment of a new supply infrastructure or ensuring more production with less energy through energy efficiency efforts.

Activities intended for decarbonizing the sector in line with climate policies account for a major part of the transformation in the energy sector. These efforts have paved the way for a reduction at the pace of fossil fuel demand.

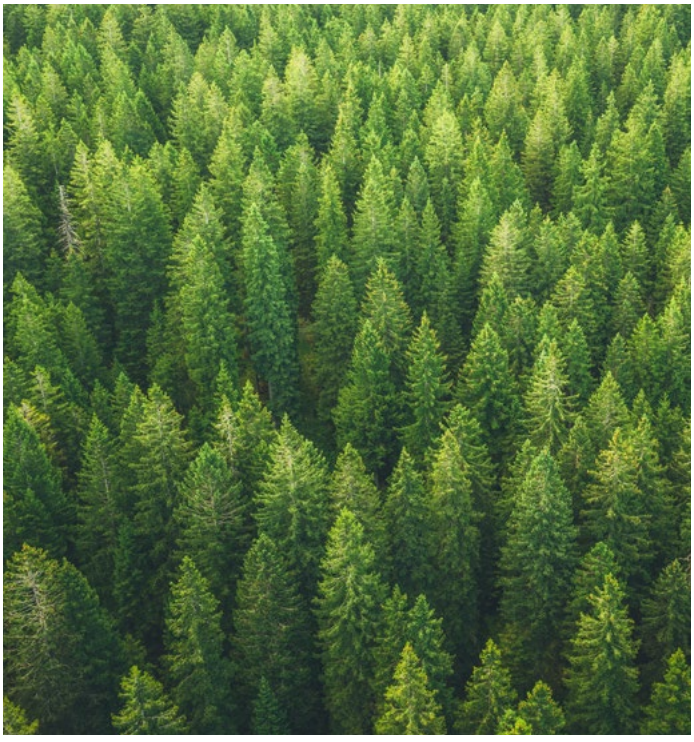
[52] https://edition.cnn.com/2020/02/21/weather/species-extinction-climate-trnd/index.html
[53] World Resources Institute, Cumulative CO2 Emissions 1850-2011
[54] Climate Watch, Historical Greenhouse Gas Emissions, https://www.climatewatchdata.org/ghg-emissions?breakBy=countries&chartType=percentage&end_year=2016&regions=WORLD&start_year=1990

In line with emerging policies, the world is going towards an objective of achieving a low-carbon environment, restructuring the global energy system. Throughout this restructuring process, it is envisaged that the global energy demand will continue to grow depending on improving welfare and living standards, but the energy demand will shift towards cleaner resources from fossil fuels and renewables will gradually play a more important role in meeting the rising energy needs of the worlds. Global studies focus on topics such as increasing the diversity of energy supply mix, offering more options to consumers, localizing the energy markets and improving integration.

It is expected that the demand for petroleum and its derivates will decline in the next 30 years. Natural gas, on the other hand, is considered to be a resource that will continue to be used longer than petroleum and its derivatives, due to its role in supporting growing and developing economies and its definition as an energy resource causing near-zero carbon emissions when combined with carbon sequestration & storage technologies. The approaches of large funds and financial institutions towards coal-fired power plants tend to "withdraw from the financing of fossil fuel-related investments". This tendency may be decisive for the development of the energy sector. It is likely that the fastest growing energy resources in the next 30 years will be renewable energy resources, especially wind and solar power. Investments made for capacity building in wind and solar power are expected to increase significantly. It is estimated that the demand for electricity will increase due to developing urbanization, the increase in the population living in cities and the widespread use of electric vehicles. Accordingly, the share of electricity in final energy consumption will increase significantly in the next 30 years. Reducing the carbon intensity of electricity generation is another strong possibility, with renewable power plants replacing coal-fired power plants gradually.

In the energy sector, emissions from electricity use can be prevented more easily than others. It is difficult to reduce the emissions of integrated iron-steel, cement and chemical industries, which are difficult to electrify, need alternative sources for low-carbon energy, and encompass high-temperature production processes. There is also a similar situation in long-distance shipping services, including land transport, aviation and maritime transport. Therefore, policies and actions intended for encouraging developments in energy efficiency are also of great importance to achieve transition to a low-carbon system.

On the other hand, climate change has important effects on the energy sector. Energy supply systems may also be exposed to various impacts of climate change, such as operational activities being affected thereby, the disruption of distribution and potential changes in demand.



2.8.1. Global Climate Actions

The possibility of climate change due to the accumulation of CO_2 in the atmosphere was first introduced in 1896, with the article written by Swedish scientist Svante Arrhenius. No measure was taken for reducing emissions from that date to 1979. In 1979, the First World Climate Conference was organized under the guidance of the World Meteorological Organization and the importance of this issue was presented to the attention of all countries.

In 1988, the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) to assess the risks of climate change caused by human activities. One of the main activities of the panel is to publish special reports and draw up technical evaluations on the issues related to the implementation of the United Nations Framework Convention on Climate Change (UNFCCC), the first intergovernmental environmental convention for global warming, signed under the leadership of the United Nations. The convention in question aims to reduce the greenhouse gas levels in the atmosphere and to keep the negative impacts of these gases at a certain level by recognizing that human-induced environmental pollution has dangerous impacts on the climate.

The Convention was opened for signature at the "Rio Conference on Environment and Development" held in Rio de Janeiro, Brazil in 1992 and entered into force on March 21, 1994 with the ratification of the countries. Following 1994, when the convention entered into force, a conference of parties, also called "COP", is held every year. A protocol created at the Berlin Summit (COP-1), which was the first of these conferences, aimed to ensure that countries would reduce their carbon gas emissions by 20% until 2005 compared to 1990. However, the protocol was not ratified and instead, it was decided to initiate a 2-year process.

Organized in Kyoto in December 1997, UNFCCC's 3rd Conference of the Parties adopted the Kyoto Protocol. The Kyoto Protocol is the first international framework to tackle global warming and climate change. Countries ratifying this protocol pledged to reduce emissions of carbon dioxide and five other gases causing greenhouse effects or to extend their rights through carbon trade. The protocol requires that countries reduce the amount of carbon they emit into the atmosphere to the levels prevailing in 1990.

Creating the framework of post-2020 climate change regime, the Paris Agreement was adopted at the UNFCCC's 21st Conference of the Parties organized in Paris in 2015 and entered into force as of November 4, 2016. The agreement aims to limit the average global temperature rise to a maximum level of 1.5°C when compared to pre-industrial levels. Today, a temperature rise of 1°C has already been achieved. In order not to surpass the target of 1.5°C, CO_2 emissions must be reduced by 45% until 2030 when compared to 2010 and net zero emission must be achieved by 2050.

Countries and regional administrations introduce various actions for the implementation of international climate policies. In this area, the EU stands out especially with the plans and policies it has introduced during the last 5 years. In March 2020, the Climate Law was submitted to the EU Parliament by the European Commission to make the net zero emission target legally binding within the EU and the legislative proposal was approved by the Commission. In addition, the European Green Deal entered into force with the aim of reducing the amount of greenhouse gas emissions, developing new business opportunities, introducing circular economy models and increasing living standards. Executed under the European Commission, the Green Deal is defined as the new growth strategy of the EU encompassing the main objectives of ensuring that there are no net emissions of greenhouse gases by 2050, economic growth is decoupled from resource use and no person and no place is left behind. The steps to be taken within the scope of these objectives are grouped under 7 policy areas. Different goals and objectives are defined under each policy area. Clean energy is one of these policy areas. Aim of the activities to be performed under this area is to support energy efficiency and develop a power sector based largely on renewable sources, secure and affordable EU energy supply and create a fully integrated, interconnected and digitalized EU energy market. From this point of view, the aim is to review the current energy legislation of the EU and revise it until June 2021, and to transpose the revisions to the national laws of the member states by 2023.

2.8.2. Development of Climate Policies in Turkey

Turkey is among the major energy consumers in the world with a developing economy. Accordingly, total greenhouse gas emissions calculated as 520.9 million tons of CO_2 in 2018 correspond to 1% of global emissions. Energy-related emissions account for the highest share (71.6%) out of the emissions generated by Turkey in parallel with the global outlook. Energy-related emissions are followed by industrial processes and product use at 12.5%, agricultural activities at 12.5% and waste at 3.4%[55].

Climate policies in Turkey began to develop in the 2000s. Turkey became a party to the UNFCCC in 2004 and then, to the Kyoto Protocol in 2009. Because of its categorization under the Kyoto Protocol, Turkey lagged behind other members of the Organization for Economic Cooperation and Development (OECD) with regard to climate policies. The protocol divides countries into different categories based on historical responsibility for emissions and financial responsibility for extending financial support to developing countries. Turkey was initially categorized under both Annex-1 countries considered to bear historical responsibility and Annex-2 countries with financial responsibility. In subsequent years, Turkey's special status was recognized and it was decided to remove the country from the Annex-2 list and keep it only in the Annex-1 list. In this case, Turkey is not subject to any emission reduction commitment under the Kyoto Protocol although it is an Annex-1 country.

Activities intended for developing the legislative infrastructure and policies for the energy sector were initiated in the early 2000s to support the climate policies in Turkey. In this respect, the Law on the Utilization of Renewable Energy Resources for Generating Electricity was enacted in 2005 in order to support and improve renewables. As in various geographies around the world, the share of renewables in both the installed capacity and generation started rising from 2009 in Turkey in parallel with the applicable climate change policies. Similarly, the Energy Efficiency Law entered into force in 2007 for the effective implementation of energy efficiency. The National Energy Efficiency Strategy Paper was issued in 2012. The Regulation on the Monitoring of Greenhouse Gas Emissions, a regulation directly related to climate change, was published in 2014 while the communiqués under the regulation were issued in subsequent years. The National Energy Efficiency Action Plan was announced at the beginning of 2018. Besides, Turkey contributes to voluntary national reduction commitments through the "Climate Change Strategy" and "Climate Change Compliance Strategy and Action Plan" published in 2010 and 2011, respectively.

Turkey is among the first countries that signed the Paris Agreement in 2015. For the reasons listed above, the agreement signed has not yet been ratified by the Grand National Assembly of Turkey. All these developments show that Turkey is striving to create a development path attaching more importance to climate priorities when compared to previous periods. Although desired radical steps have not been taken in some areas yet, it is possible to say that the general tendency is parallel with global climate trends. As with many topics related to climate from waste management to the protection of forests and the efficient management of water resources, a quest is going on for evolving into a greener and more environmentally sensitive system also in the energy sector.

[55] TurkStat, Greenhouse Gas Emission Statistics, 1990-2018.

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