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SAKARYA GAS FIELD:

ENERGY SECURITY AND GEOPOLITICS

İSHAK TURAN
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AVRASYA ÇALIŞMALARI UYGULAMA VE ARAŞTIRMA MERKEZİ
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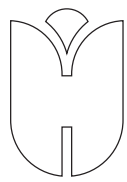

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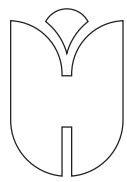

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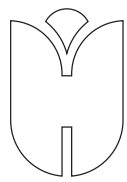


SUMMARY

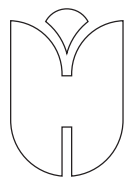
Sakarya Gas Field Development Project, carried out by Türkiye's national energy company, Turkish Petroleum Corporation (TPAO), consists of Subsea Production System (SPS), the Onshore Production Facility (OPF), and Subsea Umbilical, Risers and Flow lines (SURF). Within this project's scope, the first natural gas production was realized at Sakarya Gas Field in May 2023 and offloaded to the national grid via Pipelines Petrol Transport Corporation (BOTAŞ) shortly after all the necessary tests were completed.

The Sakarya Gas Field, where the natural gas was discovered in the Black Sea, 170 km offshore from Filyos in the province of Zonguldak, is located in the Exclusive Economic Zone (EEZ) of the Republic of Türkiye. As a result of its drilling activities in the Black Sea, in 2020, the Fatih drilling ship reached the first serious natural gas discovery of Türkiye in history with a total of 405 billion cubic meters (bcm) in the Tuna-1 well. Another 135 bcm of natural gas was discovered in the Amasra-1 well in 2021. In December 2022, the current reserve amount increased to 552 bcm with revaluation and reached 710 bcm in total, with 58 bcm of additional exploration in Çaycuma-1 well in the same month.

In December 2020, it was decided to deliver the discovered natural gas in the Sakarya Gas field to the onshore gas processing facility to be constructed in Filyos. The suitability of the Filyos Valley Project land conditions, the availability of a suitable space for the installation and distribution of natural gas processing facilities, and the presence of a high-capacity ready port for drilling vessels, seismic research vessels, and other support vessels used in natural gas exploration and extraction activities were decisive factors in making this decision. It aims to produce 40 million cubic meters (mcm)/day of natural gas within the projected Phase-1 and Phase-2 scope.

This study will reveal the paradigm shifts in the national energy policy that enabled the success of natural gas discovery, the reflections of the natural gas that will be converted into production on the energy supply security of Türkiye and its socio-economic contributions to the region, and the technical stages of the natural gas discovered in the open sea.

Key Words: Natural Gas, Energy Security, Sakarya Gas Field, Filyos Valley Project, Geopolitics



CHAPTER I

Introduction

Positive signals were received during the natural gas exploration activities initiated by the Oruç Reis seismic research vessel off the Western Black Sea coast in 2018. The first drilling works were started in the region in 2020. At the end of 2022, a total of 710 billion cubic meters of natural gas was discovered in the Sakarya Gas Field. The extraction of the discovered natural gas, with its conversion into production and offloading to the national grid, is called the Sakarya Gas Field Development Project (SGFD Project).

As a result of the research on land and sea, it has been determined that the most feasible place for delivering the discovered natural gas is the Lower Filyos Valley, which is located within the borders of Zonguldak province. The OPF to be built in Filyos as part of the SGDF Project covers an area of 215 hectares allocated to TPAO on the east of Filyos River, and the facility consists of 5 sections: Utility, Block-1, Block-2, Block-3, GIS-Substation, and Transformer station. It is planned as Phase-1 and Phase-2 Block 1, Phase-3 and Phase-4 Block 2, Phase-5 and Phase-6 Block 3, and it aims to produce 40 mcm/day of natural gas in each block.

After the gas is measured at the Fiscal Melting Station (FMS) of BOTAŞ, it will be offloaded to the national grid in Kardeşler village in Zonguldak via a 36,8 km onshore pipeline within the scope of Phase-1. The construction of the Pipeline was completed in October 2022. Within the scope of Phase 2, the gas will be delivered to the national grid in Sakarya via a 180 km onshore pipeline, which is still under construction.

The discovery of natural gas in the region and the decision to convert it into production in Filyos has caused spatial variability in the area designated as the Filyos Valley Project. Factors such as the presence of a port with a capacity of 25 million tons/year in the area, the existence of a sufficient area behind the port to construct a processing and production gas facility, and the fact that the region is located at the closest distance to the Sakarya Gas Field, led to the decision to conduct the SGDF Project in Filyos.

Many findings have been reached at the end of this academic scientific research that lasted 11 months. The findings can be divided into four categories: "national energy fleet and energy security policy approach that brought the success of Sakarya Gas Field discovery," "reasons to offload natural gas in Filyos and spatial variability," "stages of conversion of discovered natural gas to production," and "the effect of Black Sea discovery on Türkiye's national energy security."

This study aims to evaluate the energy supply of Türkiye and demand situation, the rising share of natural gas in energy, and to reveal the possible effects of the 710 bcm natural gas reserve discovered in the Sakarya Gas Field in the Black Sea on energy security of Türkiye and its dream of becoming a hub country. It also aims to reveal the spatial variability seen in the Filyos Valley Project with the discovery of natural gas and the socio-economic contributions to the region.

This study addresses the following issues: the energy security policy of Türkiye by comparing it with global energy trends and approaches, how to ensure a sustainable and competitive economy with the natural gas discovered in the Black Sea, determining the investment and employment conditions that will provide the development of the region, and lastly the spatial variability and transformation processes that will occur within the SGDP Project.

Method

This study deploys the case study approach, one of the qualitative research methods. The case study method can focus on a single point as well as offer a broader approach to life and society (Berg & Lune, 2019: 325). The most essential feature of this approach is the in-depth investigation of one or more situations. In other words, the factors related to a situation (environment, individuals, events, processes, etc.) are investigated with a holistic approach and focused on how they affect the relevant situation as well as how they are affected by the relevant situation.[1] In case studies, a multidimensional data collection process is used. In this context, data to be used in the study has been collected through interviews, observations, and document analysis.

In the study, field observation was taken to reveal current facts and events in field studies within the scope of the qualitative research method. In this context, the field research was carried out at seven different times between February and December 2022. Thus, the survey method in situ was realized successfully in this study. For the reliability of the observation data collected, it is found valid and often necessary to record the data in a short time and have at least two observers.[2] In this context, both researchers noted the observations during the field studies independently during the day.

Within the scope of the study, approval was obtained from the Human Research Ethics Committee of Zonguldak Bülent Ecevit University, and interviews were conducted using semi-structured questions. A purposive sampling selected for the interviews and authorized persons working in stakeholder institutions and organizations (Zonguldak Governorship Special Provincial Administration, Çaycuma District Governorship, Western Black Sea Development Agency (BAKKA), Turkish Petroleum Corporation (TPAO), Pipelines and Petrol Transport Corporation (BOTAŞ), Zonguldak Chamber of Industry and Commerce, Bartın Chamber of Industry and Commerce, Çaycuma Chamber of Commerce, Çaycuma, Perşembe, Saltukova and Filyos Municipalities) and detailed interviews were scheduled in advanced by appointment.

The notes taken during the interview are subject to member control to increase reliability in qualitative research.[3] In this respect, they checked the notes obtained from the interviews with the stakeholders, as mentioned above, confirming that the records were correct and complete.

Twenty interview questions were determined to reveal the effects of the natural gas discovered on the SGDF Project, their expectations as stakeholders, and their criticisms or suggestions for the project. The opinions of three experts in their fields were consulted on the academic relevance of the prepared questions. The questions were revised and updated in line with expert opinion, and a semi-structured interview form with 16 questions was used.

Both researchers independently coded the interview data, and the content was created. Then, the codes with consensus and disagreement were determined, and the compliance rate was determined. The reliability formula of Miles Huberman (1994) was used to determine the agreement rate (Reliability Formula: Consensus / (Agreement +

Disagreement) x100). Consensus among coders is supposed to be at least 80 percent.[4] As a result of the calculations, it was determined that this rate was over 85%. Accordingly, it is possible to say that the research is reliable since the analyses of the independent researchers yielded highly similar results.

Conceptual Framework

The competition and power struggle over the control of transit energy routes between energy-producing countries and regions, such as the Middle East and Caspian Sea basin, and the countries that consume a lot of energy, such as the USA, E.U., China, Japan, and India has been a global chess game.[6] But today, within the norms of globalization, the energy of geopolitics is based on the complete protection of energy resources and routes rather than occupying countries with energy resources, and it continues to be the most critical determining geopolitical factor in international relations.

Increasing urbanization and vehicle use due to industrialization have made it necessary for developed and developing states to secure more energy resources. The desire of these states to benefit from the rich fossil resources in different geographies has significantly increased the competition and conflicts between the great powers. Even though half of the proven natural gas reserves in the world are in the Middle East, the fact that North America and Russia produce 2/3 of the total natural gas production shows the market competition between producing countries in terms of availability.[5] In other words, the competition and power struggle over the control of transit energy routes between energy-producing countries and regions, such as the Middle East and Caspian Sea basin, and the countries that consume a lot of energy, such as the USA, E.U., China, Japan, and India has been a global chess game.[6] But today, within the norms of globalization, the energy of geopolitics is based on the complete protection of energy resources and routes rather than occupying countries with energy resources, and it continues to be the most critical determining geopolitical factor in international relations.[7]

The main reason why energy is seen as a national security issue is that it is the main element of economic stability or development. If energy-dependent countries experience potential energy supply problems, all segments and sectors of society will be adversely affected.[8] In this light, the definition of energy security may differ for countries that sell, buy or transfer energy resources. In other words, energy security does not have a single definition and dimension, but it affects all aspects of our socio-economic life. The general strategy of energy security for

energy-deprived countries is to reach energy uninterruptedly and at reasonable prices, as well as to use existing energy efficiently and to reduce dependence on imported energy.[9] Energy supply security can also be defined as the reliability of the source country supplied, the uninterrupted production of the energy source, and the safe transportation of energy from the seller to the buyer country.[10] That is why many energy-dependent countries invest in renewable energy resources and try to increase energy efficiency for a sustainable economy or diversify imported countries and routes. In addition, if there are potential oil or gas reserves on land or in the open seas around those countries, states may choose to set aside a budget to explore and extract them. On the other hand, energy security includes many factors in the supply of energy, such as wars, conflicts, terrorist activities, political or economic instability, cyberattacks or accidents that may occur in production, distribution problems, or excessive competition.[11] These predetermined, invisible risks and new challenges that the states must face make carrying out their energy security policies difficult.

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As Erahman and Purwanto state, there are also four essential dimensions in energy security: "availability (existence), affordability (reasonable energy price), accessibility (geopolitical obstacles), and acceptability" (clean environment concern).[12] That is why energy security is also known as the energy supply. These 4A dimensions of the energy supply can be accepted as a part of the energy system directly related to energy security and help experts analyze the model-based scenarios.[13]

The natural gas discovered in the Black Sea plays a significant role in reducing the energy dependency of Türkiye in terms of availability, and it is expected that the discovery will partially provide an "affordability" advantage in prices in the medium term once it is commercially produced.

The availability of energy has always been a concern for governments since the Industrial Revolution, which first started with

coal. Then, oil and natural gas became basic needs in developing economies and the routine lives of human beings.[14] States want reasonable price stability in energy supply to create a predictable and competitive economy. However, the fact that energy prices are open to even speculation puts energy security at risk.[15] Accordingly, the natural gas discovered in the Black Sea plays a significant role in reducing the energy dependency of Türkiye in terms of availability, and it is expected that the discovery will partially provide an "affordability" advantage in prices in the medium term once it is commercially produced. The fact that countries with rich energy resources and industrialized countries that consume energy excessively are located in different geographies poses a serious problem regarding accessibility in energy security. The natural gas to be obtained from the current Sakarya Gas Field exploration in the Black Sea, where there is no disputed territories problem or the issue of demarcation of maritime jurisdiction like in the Eastern Mediterranean, will ensure this supply is commercially accessible to public use safely. The Greek Cypriot Administration (GCA) wants to unilaterally extract and use the potential natural gas around the island, but some of the so-called zones GCA divided into parcels are not recognized by Türkiye due to the right of EEZ, and that causes the potential natural gas not to be evaluated in the region.[16]

Since the geopolitical dimension of energy security is defined as an "adequate, affordable, and reliable" energy source, the desire to consume energy cheaply in the capitalist system causes both energy-environmental dilemmas and geopolitical rivalries.[17] Since sustainable development and growth are among the most critical priorities of governments, the rapid demand for fossil resources causes an increase in carbon dioxide, global warming, and climate change.[18] The relationship between the environment and energy consumption is closely related to the state of nature. For this reason, it is not always possible to obtain the same efficiency from renewable energy sources and nuclear reactors. For example, in France, many nuclear reactors were shut down between 2003 and 2009 due to the warming of the river water in the summer.[19] The electricity obtained from wind, energy, or dams is closely related to climatic conditions. It is understandable that states still feel obliged to continue using fossil fuels, which they find more reliable, and invest in this area.

Energy and Environmental Security

Environmental-economic dichotomy also shows that a global transformation in energy resources is not easy in the short run. For example, even the E.U. countries, which took bolder steps in this respect with the European Green Deal Agreement, included natural gas and nuclear energy among their green investments to overcome the energy supply crisis they experienced due to the Russia-Ukraine war. In the draft proposal of the E.U. Commission, licensing of nuclear energy investments will be allowed until 2045, while investments that will enable electricity generation, accelerating the transition from coal to renewable energy, will be allowed until December 31, 2030.[20] The vote to veto this law in the European Parliament on June 06, 2022, was rejected by

278 votes to 328.[21] In this direction, by using clean energy resources in industrial and agricultural production, Türkiye can ensure that the European Union maintains or even increases Turkish supplies within the "European Green Deal" framework.

Natural gas contributes to reducing environmental pollution as a hydrocarbon-based fuel that is cleaner, more environmentally friendly, and causes less greenhouse gas absorption than other fossil fuels.[22] According to the data in the natural gas report prepared by GAZBIR,[23] Türkiye saves an average of 2 million tons of carbon emissions every year thanks to the increasing residential use of natural gas. Türkiye released 276.3 million tons of carbon dioxide in 2010, 340.7 in 2015, and 369.5 in 2020, respectively, and while the annual total increase rate in the world is 1.4% in the last ten years, it is 3.4% in Türkiye.[24] Türkiye, which emits carbon at a rate that is approximately 2.5 times higher than the global average, can increase its carbon emission savings by consuming natural gas instead of oil and coal and using more renewable energy sources in electricity generation.

Energy Security and Sustainable Economic Growth

Although energy supply has become increasingly vital in economic growth since the 1970s, macro-economists still ignore the importance of energy in manufactured products.[25] Because technological development is the only reason for sustainable growth in the neoclassical growth theory.[26] Meanwhile, the Russia-Ukraine war shows that the European states, which have energy supply problems nowadays, have had to reduce their energy consumption and production. Moreover, rising energy-based prices and the high cost of living caused by inflation increase the discontent in societies. Therefore, one of the most essential elements of sustainable growth and economic development is the sustainable energy supply and the availability of this energy at affordable prices. As Aykiri[27] finds, "the 'energy supply security' phenomenon has become an indispensable element of economic and national security."

Natural gas can be used as a raw material in many ways, such as synthetic polymers, plastic materials, rubber, artificial fibers, PVC, ceramics, and the metallurgy industry. In this direction, the realization of natural gas exploration investments in the Black Sea, which has the potential to partially reduce the energy supply problem necessary for sustaining its sustainable economic development, is also compatible with environmental concerns.

It is observed that energy consumption and dependency have increased in parallel with the increasing industrial capacity and urbanization, especially since the 1980s, when Türkiye adopted neoliberal

policies. Rising energy prices also pose a serious obstacle to realizing macroeconomic targets. While Türkiye's dependency ratio on energy imports (the ratio of energy imports to total imports) was 52.7% in 1990, it increased to 69.64% in 2010 and 75.64% in 2018.[28] In a study on the figures given in the trade balance between 2000-2013, due to the increasing energy import costs of Türkiye, the share of energy imports in total imports increased from 21% to 83%. This situation caused a tremendous fiscal deficit.[29] While the current account deficit was $26 billion in 1990, energy imports were $5 billion, and the ratio of energy imports to the current account deficit was only 18%. However, although the current account deficit was 27 billion dollars after 30 years in 2020, the ratio of energy imports to the current account deficit increased to 159% due to energy imports reaching 43 billion dollars.[30] According to the official foreign trade data of the Central Bank of the Republic of Türkiye (TCMB) for August 2022, the foreign trade deficit in August was $3.11 billion (annual current account deficit was $40.88 billion), while excluding gold ($2.24 billion) and energy import ($4.03 billion) the current trade surplus is $6.27 billion this month.[31] Therefore, energy complements labor and capital for sustainable development.[32] Natural gas can be used as a raw material in many ways, such as synthetic polymers, plastic materials, rubber, artificial fibers, PVC, ceramics, and the metallurgy industry.[33] In this direction, the realization of natural gas exploration investments in the Black Sea, which has the potential to partially reduce the energy supply problem necessary for sustaining its sustainable economic development, is also compatible with environmental concerns.

Energy Nationalism as a Public Policy

In the event of a possible problem in the energy supply, countries may be exposed to vital risks, from economic development to defense.[34] For this reason, energy is directly related to the economy, industry, defense, and even foreign policy and is considered a public policy. Therefore, there is a kind of "energy nationalism" today. Governments or national energy companies operate approximately 90% of the world's energy resources.[35] According to the International Monetary Fund (IMF) data, National Oil Companies (NOCs), which control a global capital of more than 3 trillion dollars, are utilized both to manage the energy policies of the countries and to keep confidential and privileged information as they are used for strategic goals or debt and income balances.[36] According to energy expert Demir,[37] the most fundamental purposes of establishing national oil companies are as follows: 1) states reduce their dependence on international oil companies, 2) they can use national oil companies by their own economic interests and policies, 3) they can better calculate the balance of payments, and they plan more predictable budgets, 4) they can have a say in the international energy industry, 5) they will increase the qualified human resources working in this field and develop their high technology, 6) they will have more accurate information on energy deposits, and finally 7) they will ensure cheap, reliable and sustainable energy supply.

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Reducing production led to an increase in other petroleum-based raw materials and products, which also affected OPEC countries that did not have the industrial capability to produce these products. Another outcome of the oil crisis is that it created awareness in many countries to increase the number of national oil companies or to strengthen existing ones. OPEC countries, which hold more than half of the world's proven oil reserves, significantly accelerated the nationalization of foreign oil companies. Thus, it is seen that a company like Exxon, which controls global oil production, had to announce significant production cuts. Its production of 6.8 million barrels/day in 1973 decreased by 1.7 million barrels/day in 1985.[38] Also, the parallel increase in the country's income with the increase in oil prices has been effective in the rapid increase in the number of national energy companies not only in Arab and African countries but also in many countries such as Mexico, Brazil, Norway, Russia, and China.[39]

Türkiye established TPAO in 1954 to carry out activities such as hydrocarbon exploration, extraction, refining, and marketing on behalf of the public. TPAO, which has achieved remarkable discoveries of natural gas in the Black Sea with increasing investments, carries out activities to reduce foreign dependency on natural gas and oil. The Coastal Logistics Center TPAO subsidiary TP-OTC, located within the borders of Filyos Port and used during the construction phase, is also handed over to TPAO. It is worth repeating that Türkiye has achieved deep-sea explorations in natural gas only when it has had a national energy fleet.

In addition to the direct transfer of the revenues from energy sales and taxes to the government, the fact that they have an active role in achieving specific political goals in terms of supply security and industrial competition has been decisive in the increasing number of national oil companies (Noreng, 1994: 198). Thus, states gain the ability to

be less affected by external factors such as international embargoes, economic sanctions, and sudden price increases. In line with this goal, Türkiye established TPAO in 1954 to carry out activities such as hydrocarbon exploration, extraction, refining, and marketing on behalf of the public. TPAO, which has achieved remarkable discoveries of natural gas in the Black Sea with increasing investments, carries out activities to reduce foreign dependency on natural gas and oil. The Coastal Logistics Center TPAO subsidiary TP-OTC, located within the borders of Filyos Port and used during the construction phase, is also handed over to TPAO.[40] It is worth repeating that Türkiye has achieved deep-sea explorations in natural gas only when it has had a national energy fleet.

CHAPTER II

Global Energy Supply and Consumption

In parallel with the growing population, industrialization, urbanization, and increasing production and consumption opportunities, the demand for natural resources and energy is also increasing.[41] According to the B.P. Statistical Review of World Energy 2020 Full Report, energy consumption in the world has increased by approximately 60% in the 25 years between 1994-2019.[42] As seen in Table 1, oil and coal are still used at a rate of 60% in total energy consumption, the rate of natural gas and renewable energy is gradually increasing in total energy consumption in the world. In the last 25 years, while the oil ratio has decreased the most in total energy consumption, natural gas has increased the most. According to the prediction for 2050, although the ratio of fossil energy sources to total energy consumption will decrease in the future, it should not be forgotten that the amount of fossil energy consumption will increase over the coming decades. When Table 1 is examined, it can be easily seen that fossil energy resources will be used for many years in the global energy supply. In this direction, countries

will continue to invest in the exploration, extraction, and transfer of fossil resources such as natural gas in the future. However, the most pleasing development regarding environmental concerns is that while almost all the energy consumption was based on coal a century ago, the rate of coal use in the 2050s will decrease to approximately 20%.

Source:	Oil	Coal	Natural Gas	Nuclear	Renewables
1971	44,3	26,1	16,2	0,5	12,9
2020	30,9	26,8	23,2	5,0	14,1
2050	27	20	22	4,0	28

Table 1. Total Primary Energy Supply by Fuel, 1971-2050. (**Source:** IEA[43])

One of the biggest reasons for the rapid increase in natural gas consumption worldwide is the increasing preference for natural gas in electric power, industry, and buildings due to environmental concerns. Another reason is that natural gas is liquefied and transported by ships as LNG, which has outstripped the pipeline trade in global trade. As seen in graphic 1, for the first time in 2020, global natural gas trade via LNG surpassed natural gas trade via pipelines.

Natural gas in the form of LNG needs special conversion facilities or terminals compared with pipelines. For this reason, the number of LNG land terminals and floating LNG storage and gasification units (FSRU) is increasing rapidly worldwide. As of April 2022, LNG trade grew by 4.5% between 2021 and 2022, thanks to the LNG fleet reaching a total of 641 with 591 vessels, 45 FSRU ships, and 5 floating storage units (FSUs).[44] These numbers increase every year in parallel with the increasing demand. For example, the number of FSRU ships in Türkiye has increased to three in 2023 with Saros FSRU.

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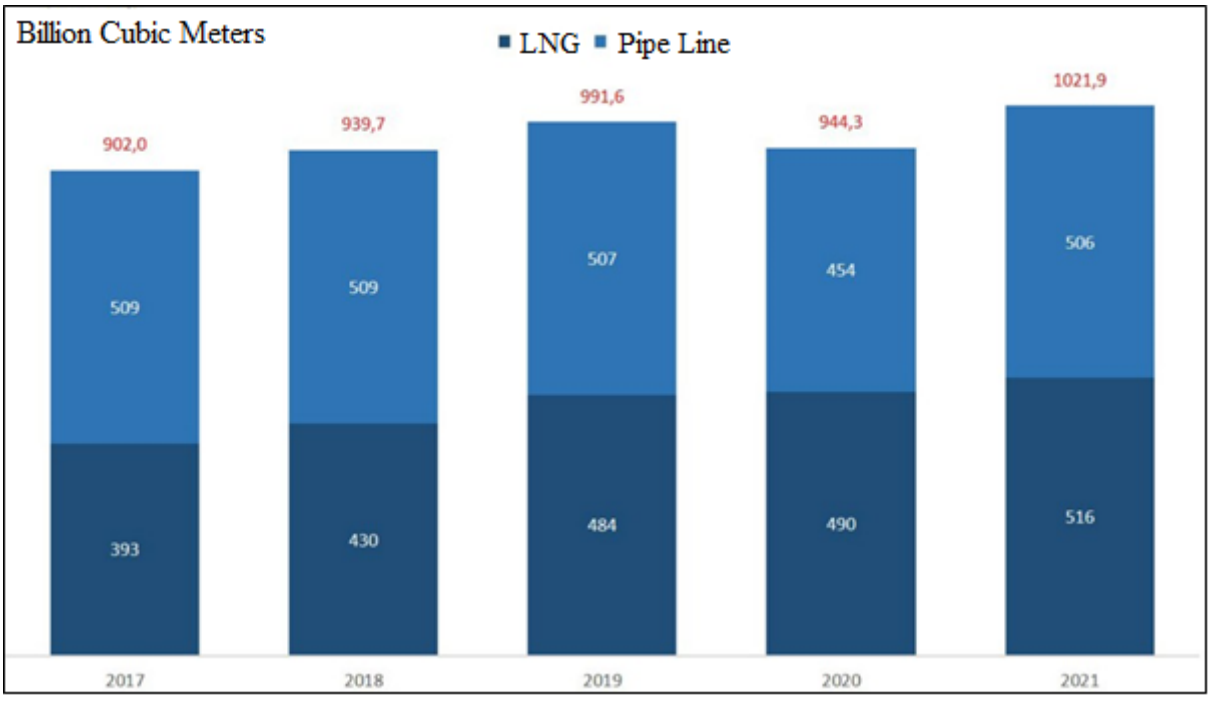

Graphic 1. Global Natural Gas Trade (**Source:** *TPAO*[45])

Production-Consumption Relationship and the Share of Natural Gas in Türkiye's Energy Security

Energy has maintained its primary role in economic and social development for many years, and the demand for energy in developing countries such as Türkiye, China, Brazil, India, and Indonesia is gradually increasing.[46] Among OECD countries, Türkiye is the country that consumes the most energy, with an annual increase of 5.5% since 2002, and its total installed electricity capacity has reached 97.37 GW from 31.8 GW.[47] According to the TPAO 2022 report, the distribution of the primary energy supply of Türkiye is as follows: 28.7% oil, 27.7% coal, 27% natural gas, 7.2% geothermal, 4.6% Hydro and 4.9% others.[48] Although the share of renewable energy sources in total energy consumption is unsatisfactory, the increasing rate is a positive step in the right direction. In the last 20 years, Türkiye has increased its total electricity installed capacity more than three times to 97,377 GW by investing in renewable sources exceeding 50 billion dollars, and that is why 52.5% of its electricity is produced from renewable energy sources such as hydroelectric (3,8GW), wind (9,58GW), solar (7,7GW), geothermal (1,59GW), biomass (0.94GW).[49] The report called Turkey Electricity Production-Transmission Statistics of Turkish Electricity Transmission Corporation (TEIAS) shows that Türkiye produces 53.33% of its electricity from renewable resources, 21.54% from natural gas, and 19.68% from coal.[50]

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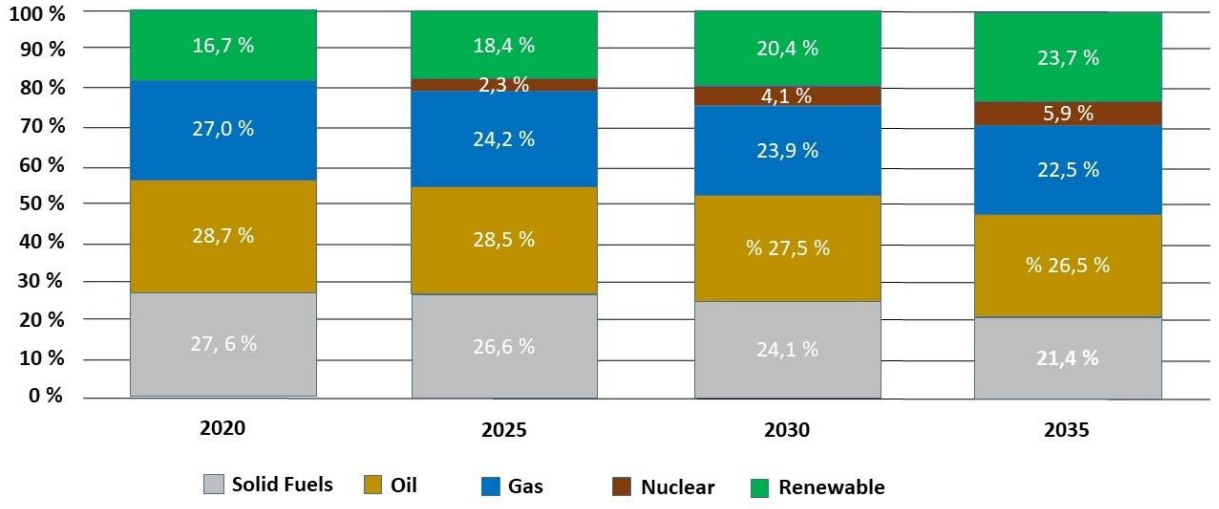
social development for many years, and the demand for energy in developing countries such as Türkiye, China, Brazil, India, and Indonesia is gradually increasing. Among OECD countries, Türkiye is the country that consumes the most energy, with an annual increase of 5.5% since 2002

Looking at Figure 3, the share of oil and coal in primary energy sources is approximately 56,3% as of 2020, and the total ratio of fossil sources rises to 83,3% with natural gas consumption. If the prediction in the Republic of Türkiye Ministry of Energy and Natural Resources report comes true, the total share of oil and coal in energy resources is supposed to decrease to 47,9%, natural gas consumption will decrease to %22,5, and consumption in renewables and non-fossil fuels will reach 29,6% in 2035. However, if the amount of natural gas to be discovered in the Black Sea reaches very high levels and the other phases foreseen in the natural gas to be produced within the scope of the SGFD Project are carried out within this period, the ratio of natural gas in total energy could be much higher.



Graphic 2. Distribution of Primary Energy Consumption in Türkiye in 2035.
(**Source:** *T.C. Enerji Bakanlığı*[51])

On the other hand, unlike the years 2010-2020, it is seen that natural gas consumption in Türkiye will follow a horizontal course in the period between 2020-2030.[52] This means that the ratio of natural gas consumption to total energy consumption will decrease. The main reason is that investments in renewable energy sources will gradually increase, and nuclear energy will be included in the primary energy sources as of 2025. Türkiye is constructing the Akkuyu Nuclear Power Plant in Mersin. This plant will consist of four reactors and has an installed power of 4800 MW. Another

nuclear power plant is planned to be built in Sinop. Thus, Türkiye will both diversify its clean energy resources and can further reduce the consumption rates of polluting environment energy resources such as oil and coal. Still, Türkiye is at risk of being directly affected by climate change and drought, and the rate of increase in hydropower from dams may decrease in the future. For this reason, while nuclear energy is vital in not increasing foreign dependency on energy, it is rational to continue investing in pipelines, land LNG terminals, and FSRU to help Türkiye reach the desired amount of natural gas supply. Unpredictable factors in energy supply can turn into a national security threat in a short time. Accordingly, Türkiye needs to continue its natural gas exploration and extraction activities in the Sakarya Gas Field or the Eastern Mediterranean.

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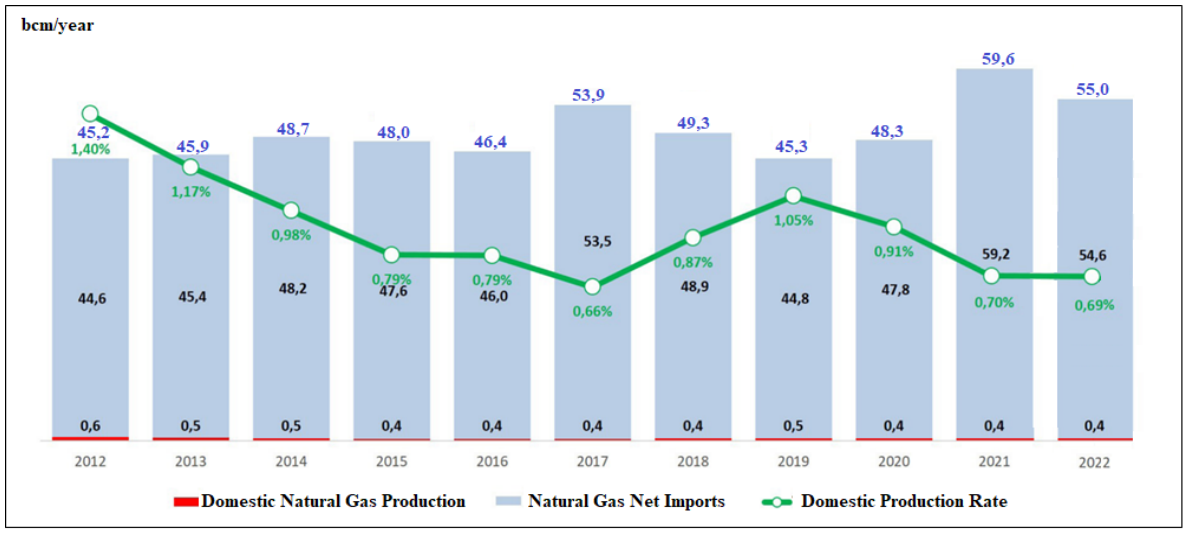
Türkiye imports natural gas from Russia, Azerbaijan, and Iran via pipelines. However, it imports LNG from different countries to diversify its energy security and secure its natural gas supply. By 2022, LNG imports in natural gas had increased to 30 percent.[53] Diversifying the number of countries, Türkiye has started to import LNG from Algeria and Nigeria as well as from other countries such as the USA, Egypt, and Qatar (EPDK, 2022: 21). Türkiye imported 38,2 (70%) bcm of natural gas via pipelines and 16,4 (30%) bcm as LNG in 2022 *(EPDK, 2023b)*. Natural gas imported in 2022 decreased by 6.07% (58.7 bcm in 2021) compared to the previous year and became 54.66 bcm.[54] Since the production at Sakarya Gas Field is not yet operational, it is seen that natural gas production will be only 379.82 mcm in 2022, which is 3.71% less compared to 2021. Exports increased by 51,86% from 360.34 mcm to 581.43 mcm in this period.[55] Thus, it is seen that Türkiye imports almost all the natural gas it consumes.

Türkiye imports natural gas from Russia, Azerbaijan, and Iran via pipelines. However, it imports LNG from different countries to diversify its energy security and secure its natural gas supply.

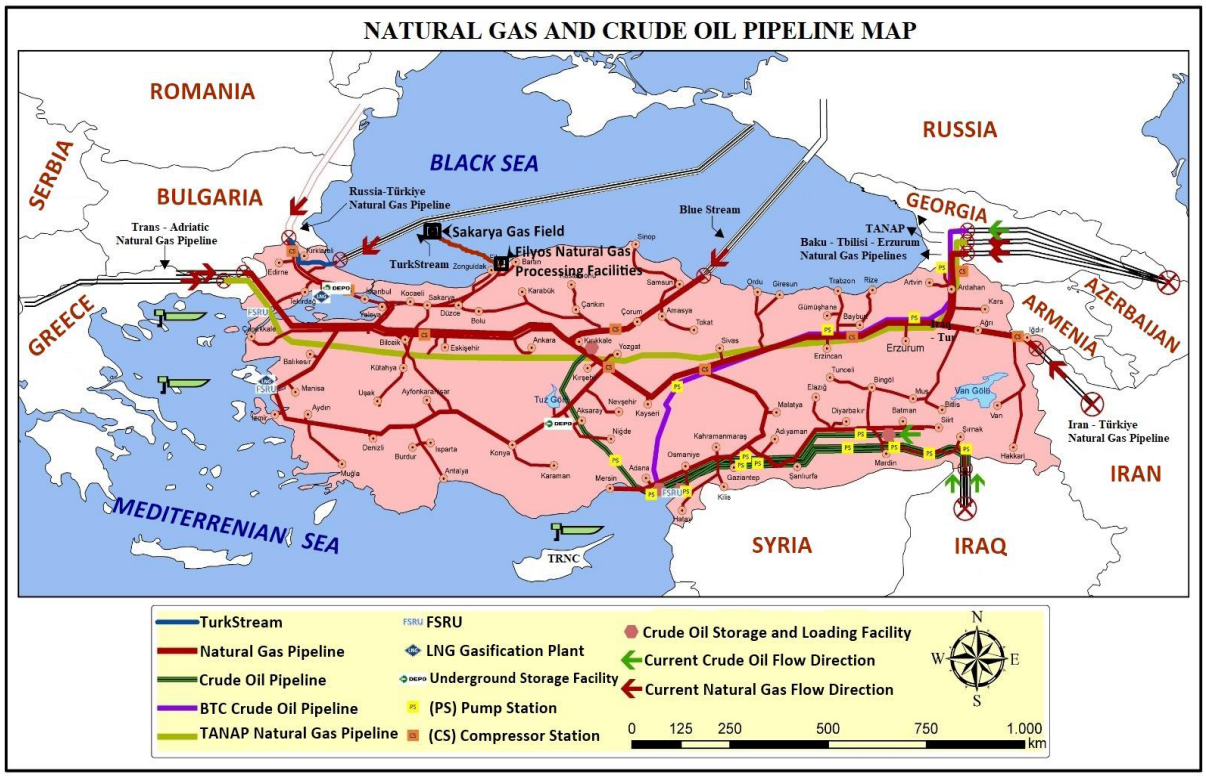
As seen in Chart 3, while natural gas imports in Türkiye have increased regularly, the production ratio to imports has decreased from 1.40% to 0.69% in the last ten years. However, these rates will change significantly with the production of Sakarya Gas Field.

In light of 2022 consumption data, the domestic consumption coverage ratio of each bcm of natural gas produced is approximately 2%. In this direction, considering that 40 mcm of natural gas will be produced daily within the scope of Phase-1 and Phase-2, natural gas consumption of 25% to 30% will be met by domestic production.



Graphic 3. Natural Gas Supply and Domestic Production Rates in Türkiye, 2012-2022. (**Source:** *TPAO*[56] *and EPDK*[57])

Türkiye, on the one hand, increases its investments, which will raise the domestic consumption rate. On the other hand, it diversifies the energy routes and the number of countries to establish natural gas supply security. Accordingly, Türkiye is increasing the number of LNG terminals and FSRUs, increasing its daily natural gas inflow capacity. Thanks to these facilities and pipelines, daily natural gas inflow capacity has increased to 381.9 mcm in 2022.[58]. Thus, Türkiye has reached almost twice the natural gas inflow capacity of the natural gas it consumes. This shows how Türkiye follows a favorable policy to overcome its natural gas supply security. In addition, underground natural gas storages with a total capacity of 10 bcm were built in Silivri and Tuz Gölü. Thus, Türkiye aims to prevent natural gas cuts in winter or in extraordinary times from interrupting industry and electricity consumption. The map below shows where in Türkiye natural gas pipelines, underground natural gas storages, LNG terminals, and FSRU vessels are located.



Map 1. Natural Gas Pipelines and Projects.

In addition to its natural gas exploration activities in the Black Sea and Eastern Mediterranean, Türkiye's negotiations with Russia, Azerbaijan, Turkmenistan, and Israel will enable Türkiye to increase its natural gas export. Thus, Türkiye can make its policy of being an energy corridor country in natural gas a reality. Increasing energy consumption in China and India not only puts pressure on global energy demand but also causes competition in global energy supply security.[59] Aware of this increasing competition, the European states' desire to gradually reduce their dependence on Russian gas highlights Türkiye as a robust alternative corridor in energy geopolitics.

Türkiye has an enormous geostrategic location as it connects the energy-rich Caucasus, Central Asia, and the Middle East with the energy-poor European continent to each other. Also, Türkiye, which acts as a bridge between Asia and Europe in the East-West trade, which has increased significantly with the Belt and Road Initiative announced by China in 2013, aims to become an "energy bridge." Located on the historical Silk Road, Türkiye can thus have a central place in goods trade and energy transfer. At a more micro level, the Filyos Valley Project, which has direct energy resources and the Middle Corridor, will set an excellent example for energy and goods trade. The natural gas discovered in the Black Sea will turn into production here, including the third-largest port and an expanded industrial zone. As energy is determined in the free market as a valuable commodity, Türkiye will need international cooperation to reap more benefits from the energy it discovers, which can engender regional cooperation, trade, and

trust.[60] Achieving its energy security, Türkiye will concentrate more on trade opportunities in its region with its increasing competitive power, increasing the importance of large-capacity ports such as Filyos Port.

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CHAPTER III

Key Findings

As a result of the observations, comprehensive and detailed analyses, literature review, and interviews with stakeholders and experts, many findings have been evaluated under the following headings:

1) National Energy Fleet and Energy Security policy approach that brought the success of Sakarya Gas Field discovery
2) Reasons to offload Natural Gas in Filyos and Spatial Variability
3) Stages of Conversion of Discovered Natural Gas to Production
4) The Effect of Black Sea Discovery on Türkiye's National Energy Security

1. National Energy Fleet and Energy Security Policy Approach that Brought the Success of Sakarya Gas Field Discovery

The energy security problem in Türkiye started in 1990 when the energy demand exceeded 50% in terms of foreign dependency, and this ratio exceeded 75% in 2014.[61] Especially in natural gas, the import rate is above 99%. Considering that Türkiye imports almost all the natural gas it consumes, the natural gas produced in the Black Sea will positively impact national energy security. In this context, what is the underlying policy of Türkiye behind the success of discovering natural gas in the open and deep seas, such as in the Black Sea?

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In the Ministry of Energy and Natural Resources of Türkiye (MENR) Strategic Plan Report 2015-2019, the ability of Türkiye to establish the security of energy supply is expressed as follows: *"oil and natural gas exploration studies, these activities should be intensified, initiatives for shale gas exploration and generation should be taken, strong domestic companies should increase their foreign contacts and initiatives and foreign sources should be introduced into domestic utilization."*[62] Although the report written in 2015 underlines the issue of the security of energy supply by reducing dependency on natural gas in electricity production and eliminating it with other renewable resources, a new policy change will be essential with the natural gas discovered in the Black Sea. As the report focuses on the rising dependence on imported energy sources, Türkiye must invent renewable sources, improve energy efficiency, and discover fossil sources to meet the increasing consumption.[63]

In line with this policy, Türkiye, surrounded by seas, has started to purchase drilling vessels to conduct natural gas exploration studies in line with the data obtained from seismic research vessels. Thus, Türkiye has acquired the ability to conduct exploration, research, and extraction activities in the seas with its means- with offshore drilling studies or three-dimensional (3D) seismic data collection and interpretation vessels. This enabled more concrete targets for the future of energy policy to be carried out in Türkiye's 2019-2023 Strategic Plan. The main objectives under the title of "Ensuring Sustainable Energy Supply Security," which is among the main objectives specified in the 2019-2023 Strategic Plan of the Ministry of Energy, are as follows:[64]

- The ratio of electricity installed power based on domestic and renewable energy resources to total installed power will be increased from 59% to 65%.
- Nuclear energy will be included in our supply resources, and the efforts to increase its share in the energy supply will proceed.
- Natural gas and electricity infrastructure will be strengthened.
- Oil and natural gas exploration and production activities will be accelerated, especially in the seas.
- Technological transformation applications will be realized in the electricity sector.

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Since energy supply is a public policy, national oil companies stand out as important actors in the energy diplomacy implemented by the states.[65] Since the Second World War, especially with the return of oil to global use, the increasing nationalization approach in energy resources and institutions in the world has also shown its effect in Türkiye. In this direction, TPAO, established in 1954, has played an active role in the exploration and production of fossil energy resources and national energy security.

Due to the lack of three-dimensional seismic research vessels capable of drilling in open seas, TPAO could not reveal serious discoveries in the open seas by its means until the seismic research vessel Barbaros Hayrettin Paşa was included in the inventory in 2012, after receiving positive signals from the research initiated by the Oruç Reis seismic research vessel, which joined the TPAO inventory in 2017, in August 2018 in the Zonguldak offshore of the Black Sea, Fatih drilling vessel, which joined the TPAO inventory in 2017, started its first drilling in the Tuna-1 well in the region on July 20 2020. It reached 405 bcm of natural gas discovery in the Tuna-1 well, with two separate discoveries in August and October in the first three months (Table 2). When it was understood that there was a natural gas reserve in the region, on May 01, 2021, Barbaros Hayrettin Paşa started to carry out seismic research in the Black Sea in wider areas. In light of the current three-dimensional seismic data, the Kanuni drilling ship started offshore drilling activities in December 2021. In April 2022, the Yavuz drilling ship started to help other support vessels construct subsea production systems and the activities to offload the natural gas discovered in the region.

Year	Discovery Well	Amount (bcm)
August 2020	Tuna-1	320
October 2020	Tuna-1	85
June 2021	Amasra-1	135
December 2022	Çaycuma-1	58
December 2022	**Reserve Growth:** With the re-evaluation efforts, the reserves in the field were revised from 540 bcm to 652 bcm.	112
Total Discovery	Three separate wells in the Sakarya Gas Field	710

Table 2. Sakarya Gas Field Natural Gas Discoveries

Türkiye, which started to get results in the investments made in the national fleet in a short time, seems determined to continue its investments. While only 951 million dollars were invested in TPAO in 2011, it exceeded 3 billion dollars in 2014 and 4 billion dollars in 2022.[66] and[67] Although it varies according to the characteristics of the works carried out within the scope of the SGFD Project, more than 50 ships are working within the scope of the project. A total of 16 of them are in the inventory of TPAO, of which 4 are drilling ships, 2 are seismic research ships, and 10 are support vessels. Türkiye, which did not have a single ship with geophysical equipment until 2012, has succeeded in owning one of the world's largest energy fleets in the last decade. In this way, Türkiye can carry out its deep-sea discoveries.

2. Reasons to Offload Natural Gas in Filyos and Spatial Variability

One of the most critical factors in determining the Sakarya Gas Field Development Project is that the Filyos Valley Project area, which also includes the Filyos Port, is the shortest distance to deliver the gas and to ensure the safety of the natural gas flow discovered in the Sakarya Gas Field. The subsea umbilical flow lines and pipelines need to be at the shortest distance to the land because the pressure and conductivity loss of the gas can be minimized in the lines, and thus, the safety of the flow can be realized.[68] The less pressure there is, the more it is possible to produce for many years. The less pressure there is, the longer the reserve life and production last. Since the most crucial factor in minimizing the pressure is the distance, the Filyos Valley Project area was preferred as the most suitable place to construct the OPF.

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The second reason to choose the Sakarya Gas Field Development Project area in Filyos is that Filyos Port, whose construction had almost been completed when the discovery was announced, has not yet been opened to national and international commercial ports. Filyos Port, the construction of which started in 2016, was put into service on June 04, 2021. Filyos Port, located within the borders of Zonguldak province, is the third largest port in the Black Sea, with an annual handling capacity of 25 million tons. Filyos Port also has the capacity to handle 13 ships of various sizes at the same time. Such a port of this size and capacity, which 16 ships in the TPAO inventory and up to 50 other support vessels must use in natural gas extraction operations, has also influenced TPAO's determination of the harbor area as an onshore gas processing facility. A temporary Coastal Logistics Center operated by TP-OTC has been established to carry out the activities here.

The third reason is the air, sea, and railway network, where road connections to the Filyos port and the facilities and logistics centers can be built behind it. Mainly thanks to Çaycuma Airport, which is only 18 km away from the project area, special equipment and vehicles brought from abroad can be delivered to the project area in a short time. The fourth reason is that there is no designated special area in this region, as well as the project area is not located in the forest area. In this way, there will be no tree-cutting and no intervention in the surrounding settlements.[69] The fifth reason is that Filyos, which has one of the most ideal transportation corridors between the coast and the interior, provides suitable topographic conditions for the construction of pipelines.

Considering all these, the Filyos Valley Project, planned for industrial investments to produce medium and high technology, has been named the Sakarya Gas Field Development Project with the discovery of natural gas. Thus, thanks to the ongoing ground improvements in the region for many years, TPAO has had the opportunity to construct the OPF facility and transfer the gas to land in a shorter time. An area of 597 hectares was initially allocated for the Filyos Valley Project. The region was announced as the SGFD Project, covering only the eastern side of the Filyos Stream. With the President's Decision dated 05.01.2022 and numbered 5071 published in the Official Gazette dated January 06, 2022, and numbered 31711, the part of the area planned as Filyos Industrial Zone, corresponding to 215 hectares to the east of Filyos Stream, has been allocated to Turkish Petroleum Corporation as Filyos Individual Investment Site.

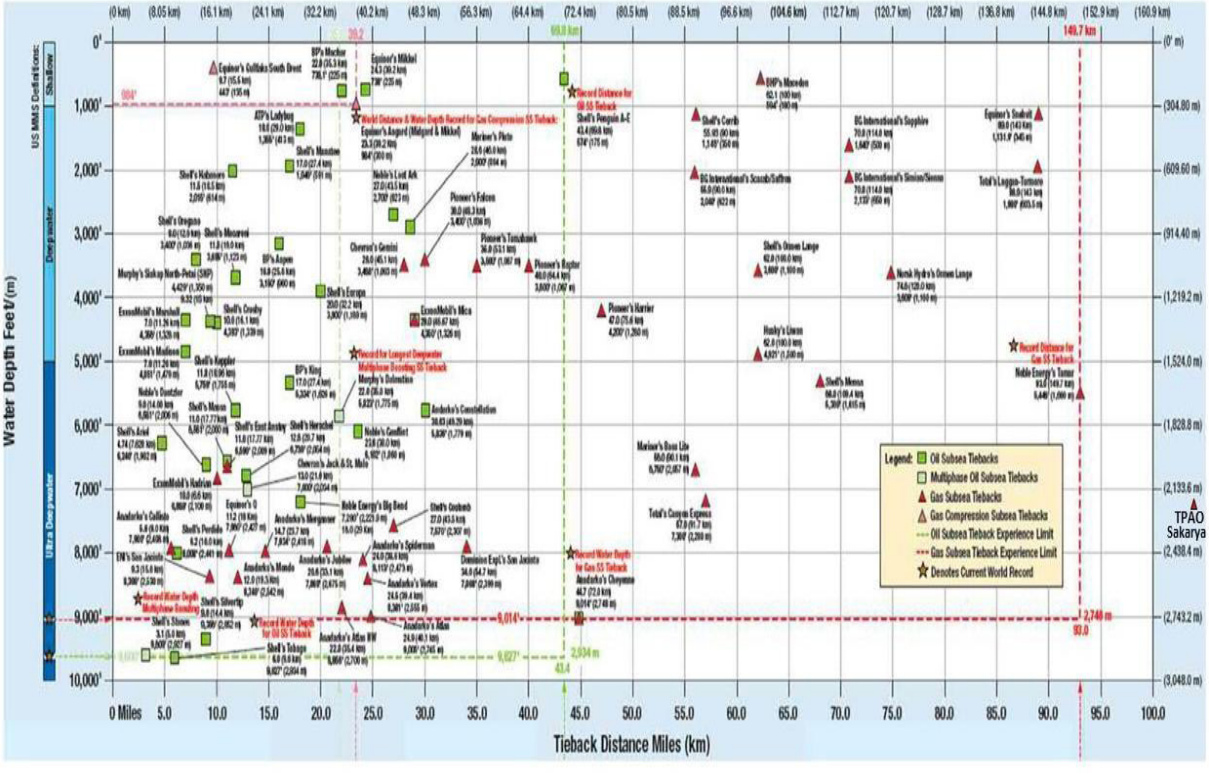
3. Stages of Conversion of Discovered Natural Gas to Production

Within the scope of Phase-1 and Phase-2 of the Sakarya Gas Field Development Project, the natural gas discovery in the Black Sea to be produced and delivered to the national grid consists of four stages:

1) Subsea Production System (SPS)
2) Subsea Umbilical, Risers and Flow lines (SURF).
3) Onshore Production Facility (OPF)
4) BOTAŞ Fiscal Melting Station (FMS) and Offloading to the National Grid

The subsea production system, subsea umbilical, risers, flow lines, and the Filyos onshore production facility to be constructed within the scope of the SGFD Project are under the responsibility of TPAO. Fiscal melting stations and offloading to the National Grid come under BOTAŞ. As mentioned before, the project area selection is based on rational and feasible reasons, and the institutional determination of the distribution of tasks has provided results in the project in a short time.

Compared to similar natural gas operations in the world, the SGFD Project is one of the world record subsea tieback water depth and tieback distance. Since the length of the map below is shown as far as 161 km, the operation carried out by TPAO is 170 km offshore, also known as the Sakarya Gas Field, has been added to the right of the map with a red icon of "TPAO-Sakarya" (Map 2).



Map 2. World Record Subsea Tiebacks
Water Depth and Tieback Distance (***Source:*** *Kaiser*[70])

Subsea Production Systems (SPS)

It is envisaged that the project's first phase will be completed to produce natural gas discovered in Sakarya Gas Field by September 2023 and deliver 10 mcm of natural gas per day from Sakarya Gas Field to Filyos OPF. With the second phase operational by the end of 2028, this amount is expected to reach 40 mcm daily. The exploration, made at a total depth of 3850 meters, will be delivered to Filyos OPF by natural gas pipelines that are 170 km long.[71] In this respect, the processing terminal on the shore of Filyos will be connected to the subsea production system by pipelines.

The subsea production system is established approximately 2200 meters below the sea, and these facilities are placed on the ground at this depth with zero margin of error with unmanned robots. Since people cannot descend to this depth, these systems are placed individually, and their connections are remotely controlled from the utility center or drillships. In the interviews with the officials from TPAO, they stated that the offshore and land operations could be controlled from the Main Command Center (CCR) in Ankara, thanks to the national software program called "ZEKİ." In addition, due to the national software, the data obtained in the drilling section will be delivered to the Filyos OPF and CCR. Thus, sustainable and efficient production will be ensured. Working in ultra-deep waters is the most technologically challenging stage because people cannot go down to such a depth.

Moreover, the facilities used in the subsea production system vary between 65 and 280 tons. These must be perfectly placed underground at the SPS, 2200 meters below the sea, and their connections with other systems and pipelines must also be made. For example, a Christmas Tree (X.T.) weighs 65 tons and is 5 meters high and 6 meters wide. Most of this equipment is taken from Filyos port with the Yavuz drilling ship and placed on the seabed with the unmanned water robot named Kâşif.

The national fleet in the TPAO inventory plays a vital role in the exploration of natural gas in the Sakarya Gas field, the drilling works, the extraction of gas, and the construction of subsea production facilities, subsea umbilical, risers, and flow lines, and umbilical termination assembly to convert the gas into production. An illustration of a subsea production facility established underground is shown in picture 1. This illustration of seabed construction shows that it was built to extract and deliver natural gas through the Pipeline. There is a Christmas Tree on each well. The production manifold is where the gas offloading from the X.T. is collected. This manifold is also connected to the Pipeline End Termination System (PLET), which will transfer the gas to land with flexible pipelines. Control lines also keep the system afloat: Subsea Distribution Unity (SDU) and Cord Umbilical Termination Assembly (UTA). Within the scope of Phase-1 and Phase-2, a subsea production system consists of a total of 40 wells in two different blocks on a 12 km long area (2173 km^2) on the seabed.[72]

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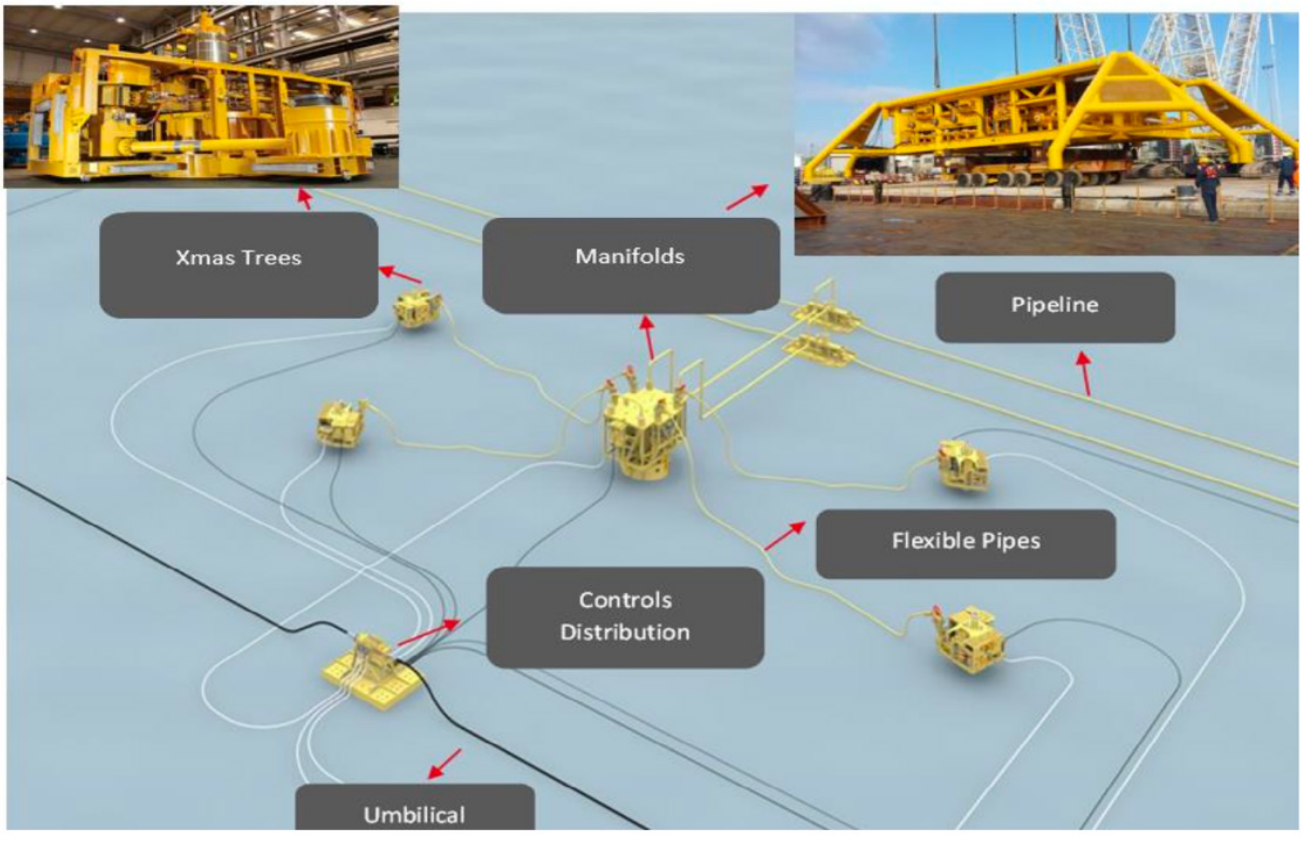
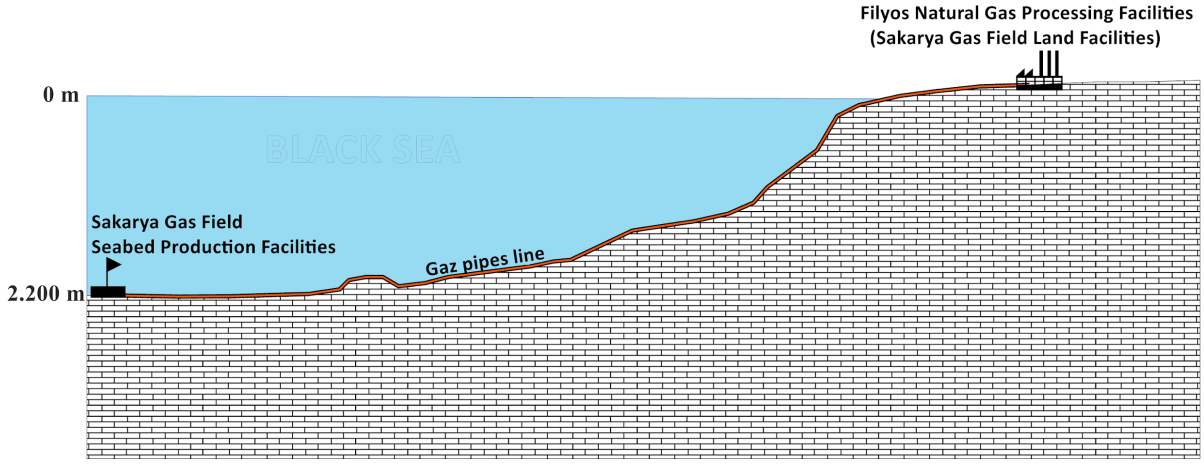


Photo 1. An Illustration of Subsea Production System. (**Source:** *TP-OTC*[73])

Pipeline Construction

The natural gas to be extracted through the seabed production system will be transmitted to the Filyos OPF via pipelines. The pipes laid on the seabed at a depth of 2200 m from the surface, along 170 km with an average slope of 4.4 per thousand, were also laid on a plateau of about 12 km offshore on a 5 km line and even with a high slope of 296.9 per thousand. It reaches the land facilities with an inclination of approximately 2.2%. The pipes reach the onshore facilities approximately 7 km from the coast with a slope of approximately 2.2%. The plateauing of the topography and the existence of submarine canyons complicate the construction of pipelines (Map 3). In order to eliminate the geological risks such as flowing, sliding, or landslide that may arise towards the seabed, necessary research was carried out for the construction of the pipelines on a correct route. Moreover, due to the high amount of Hydrogen Sulfide (H2S) present on the seabed, appropriate material selection and laboratory tests have also been carried out to ensure the long-term durability of the pipelines.



Map 3. Topography Section of Pipelines

It consists of three parallel pipelines with a length of 170 km to deliver the natural gas from the seabed production facility to the Filyos OPF.

The Pipelines:

1) Gas Pipeline (16 inch- 40,64 cm)
2) MEG Transportation Pipeline (10 inch- 27,3 cm)
3) Umbilical Pipeline (6 inch- 15,24 cm)

The first Pipeline is the 16-inch main flow line, which will deliver the natural gas to the field. Since the capacity to be transported in the second phase will be three times that of the first phase, the Pipeline to be used in Phase-2 production is planned to be 24 inches (60.96 cm). The second Pipeline is the 10-inch MEG pipeline, also known as the Mono ethylene glycol or antifreeze line. Through this line, chemicals will be infused into gas by injecting it into the well heads and turning back to the land mixed with gas through the gas line.[74] To succinctly, MEG

will be used to clean and separate sand, water, or other impurities to sustain operations on the seabed. The MEG pipeline, which injects glycol in a way to prevent some water that can be transported in the reservoir from freezing during the process, is made of 3LPP (3 layers of polypropylene) with a minimum thickness of 3 mm, which is coated on the outside of the pipe for corrosion protection of the pipelines.[75] This material is resistant to high operating temperatures and provides mechanical protection as well as corrosion protection. Finally, the third Pipeline is the 6-inch seafloor fiber cord tie (umbilical) that carries electricity to the seabed generation facility. It can also be called the automation lines system/energy system, which will control the entire system built underground and run the smart system. Laying all these three pipelines into the sea with the Bahamian flagged ship Castro-10 (pipe burying vessel) was completed in November 2022. An average of 4-5 km of pipes were laid per day.

Filyos Onshore Production Facility

Filyos OPF, built within the scope of the SGFD Project, was completed as of February 2023, and the first torch was lit on the field on April 20, 2023. Filyos OPF, built in the area designated as the Filyos Valley Project, in the back area of Filyos Port, will be the first point of natural gas to be connected to the land by pipelines. In these facilities, the gas to be transferred from the Sakarya Gas Field will be separated, filtered, pressurized, and sent to the fiscal melting station. Gas extracted from underground is unsuitable for consumption as we use it at home. The gas contains too many impurities, heavy hydrocarbons, or substances such as sulfur. Separation of these substances from the gas and testing will also be carried out in these facilities. For this reason, a natural gas processing plant can also be called a chemical plant. After all these processes are completed, the commercial production of the gas offloaded to the national grid will begin. It is envisaged that the natural gas reaching the Filyos OPF will be delivered to the national grid in the second quarter of 2023.

Filyos OPF, built within the scope of the SGFD Project, was completed as of February 2023, and the first torch was lit on the field on April 20, 2023.

Phase-1 has been designed and has started producing ten mcm/day (3,6 bcm/year) of natural gas at the Filyos OPF since September 2023. In Table 3, the amount and time of total production have been tried to be revealed by calculating the possible 6 phase stages. The Phase-1 production phase continues, and Phase-2 has also been projected. Within the scope of Phase 2, it is aimed to drill 30 more wells and produce a total of 40 mcm/day of natural gas by the end of 2028.

Phase	Blok		Prescribed Date	Prescribed Amount (Million cubic meters/day)
Phase-1	Block-1	First (5 wells)	July 2023	10
		Second (5 wells)	April 2024	
Phase 2A	Block 1	Ten wells	By 2025	10
Phase 2B	Block 1	20 wells	By 2028	20
Phase 3	Block-2	Not projected	By 2030	20
Phase 4	Block-2	Not projected	In 2030s	20
Phase 5-6	Block-3	Not projected	In 2030s	40
Total				**120**

Table 3. Future Production Scenario and Capacity at Filyos OPF

SGFD Project has a natural gas production capacity of 120 mcm/day in three blocks. Considering Türkiye's increasing natural gas consumption every year, in the mid-2030s, Türkiye will be able to obtain at least half of the natural gas it consumes from the Black Sea exploration. In the observations made in the field, it was seen that the Phase-2 ground was suitable for constructing a natural gas processing plant. It was observed that the ground of the other phases was suitable for constructing other OPFs. Since additional discoveries are expected in the region, it has been observed that necessary improvements have been made on the Phase-3 and Phase-4 fields so as not to be caught unprepared in the future (Map 7).

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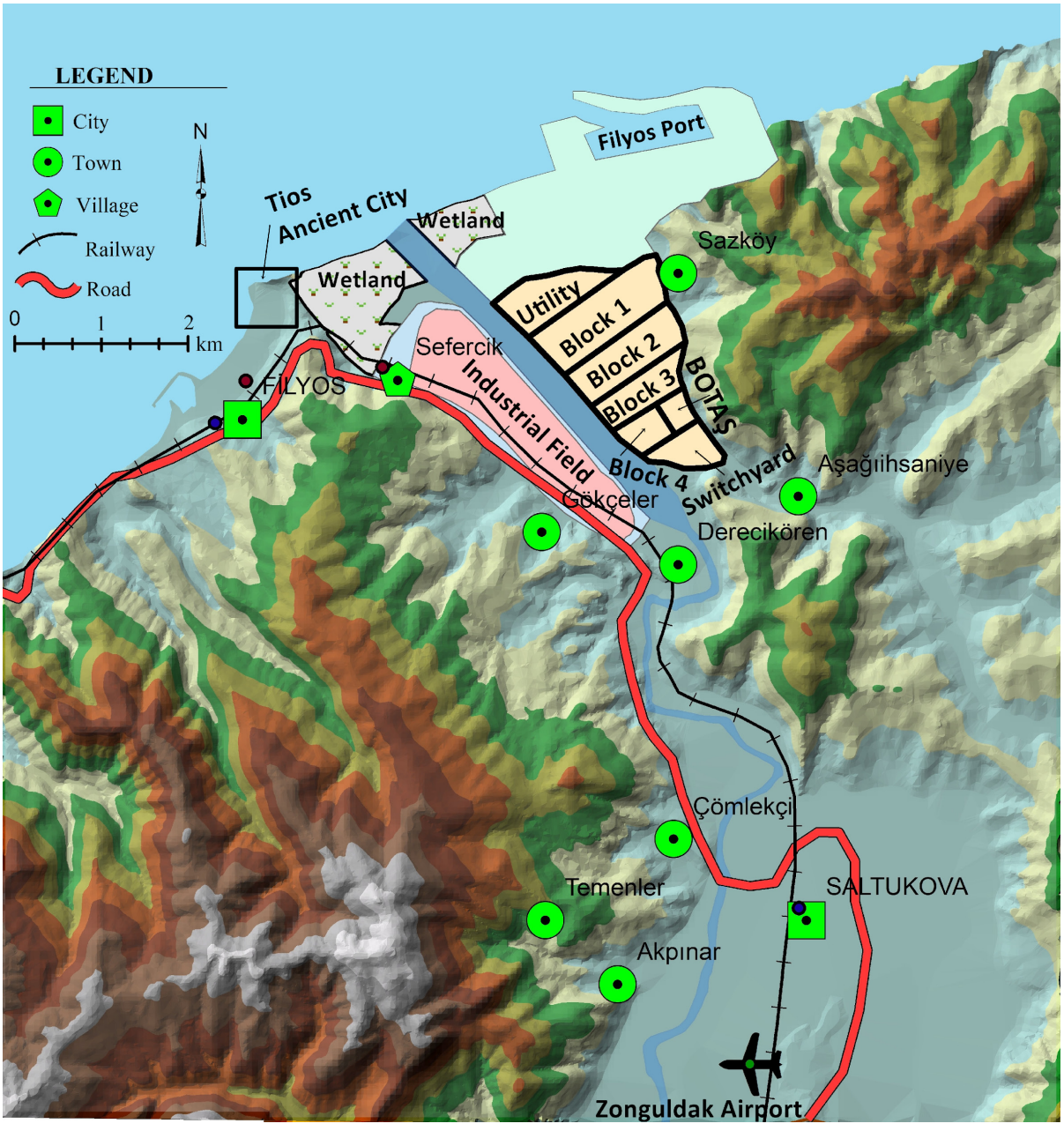

Map 4. Sakarya Gas Field Onshore Facilities.

There were also serious difficulties in constructing the base of the land on which the facilities were established. The most significant difficulty experienced in the construction of the facilities is that the SGFD project area, which was previously determined as a part of the Filyos Valley Project, causes a wetland (water-saturated) ground filled with alluvium brought by the Filyos Stream flowing into the sea. For this reason, even before the SGFD Project was announced, soil improvement was made in the region:

- 1400 km of soil improvement was made.
- Several treatment options, such as chemical oxidation, electrochemical, biological, and filters, were assessed and evaluated for the disposal of produced water.

- A total of 17200 drainage columns with an average diameter of 80-100 cm and a length of 30-35-40-45 meters were built.
- Forty thousand piles (including 5,500 bored piles) were driven and completed in 120 days.
- Soil samples were collected via drills, and almost 1000 soil surveys were carried out at depths ranging from 15 to 75 meters.
- The process was completed with 37 machines (pile machines) running in 3 shifts for 24 hours.
- This project used two of the four machines that drive the deepest piles in the world.
- Local companies took part in these projects. For example, Özardıç firm (Bartın) has driven approximately 12 thousand piles, which corresponds to approximately 30% of the total piles driven.

Offloading the Gas to the National Grid

The fourth and final stage in the SGFD Project is transferring the natural gas to be produced at the Filyos OPF to the Fiscal Melting Station and then to the national grid. There is no storage facility in the SGFD Project. For this reason, the natural gas produced will be directly transferred to the BOTAŞ Fiscal Melting Station, which is only 250 meters from the Filyos processing plant. The facility was completed in December 2022 and is ready to deliver the gas to the national grid. During the interview with BOTAŞ authorities, it was stated that pressure adjustment procedures would be carried out in this facility to make it suitable for transferring natural gas to the Pipeline. In addition, BOTAŞ completed the construction of a 36,8 km long 48-inch-wide pipeline that will deliver the gas to the national network in Kardeşler village, located within the borders of Zonguldak, in October 2022. BOTAŞ is also constructing the 180 km long Pipeline that will deliver the gas to be produced under Phase-2 from the distribution system in Kardeşler village to Sakarya.

4. The Effect of Black Sea Discovery on Türkiye's Energy Policy

While Türkiye imports 3/4 of the energy it consumes, this rate is 99% in natural gas, and the cost of natural gas imports increases in parallel with the increasing economic activities and population.

The natural gas to be produced within the scope of the SGFD Project is expected to positively affect both Türkiye's natural gas supply security and its role as an energy corridor. Türkiye spends approximately 40 billion USD annually on energy imports, of which approximately 12.5 billion dollars is natural gas.[76] In other words, it is approximately 1/3 of the cost of natural gas in energy costs. With the Ukraine-Russia war, this cost was doubled, but in the first quarter of

2023, prices again approached rational and predictable levels. While Türkiye imports 3/4 of the energy it consumes, this rate is 99% in natural gas, and the cost of natural gas imports increases in parallel with the increasing economic activities and population.[77] As mentioned earlier, natural gas consumption in 2020 is 48.1 bcm, in 2021 58.7 bcm, and 2022 54.66 bcm, respectively. In short, it is predicted that Türkiye will consume 50 to 60 bcm of natural gas in the short and medium term. Moreover, the increase in global warming and drought may cause the possible loss of hydroelectric production to be supplied from natural gas. These all show that natural gas will remain important in the Turkish economy and the security of the energy supply. In this respect, it is a positive development that a specific part of the natural gas demand will be met by the discovery of 710 bcm of natural gas discovered in the Black Sea. Within the scope of the SGFD Project, 3.5 bcm of natural gas per year in the Phase-1 phase and approximately 14,5 bcm of natural gas production in the Phase-2 phase are targeted. TPAO will be able to produce 14.6 bcm of natural gas, which corresponds to approximately 25% of annual consumption, with a gradual increase in production until 2028.

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It is seen that the prominent sectors in natural gas consumption in Türkiye are electricity, industry, and housing, respectively. When the sectoral consumption between 2020 and 2022 is analyzed, electricity consumption increased from 13.6 to 14.5 bcm, industrial consumption increased from 12.8 to 13.4 bcm, and residential consumption increased from 15.4 to 18.05 bcm.[78] The ratio of the total natural gas consumption of the three main sectors has increased from 88% to 90% at that time.

In light of these data, it is predicted that in case the natural gas to be produced in Filyos within the scope of Phase-1 and Phase-2 reaches total capacity, the natural gas consumed in industry or electricity generation in Türkiye will be met by domestic production in 2022. Regarding energy supply security, it is vital that the increasing natural gas consumption in these three sectors, which have an important place in sustainable development, will be supplied from domestic production in the Black Sea at a rate of 25% within the scope of the first 2 phases. In addition, if additional discoveries are made in the region and TPAO continues its investments in the region, natural gas consumption within the scope of Phase-3 and Phase-4 could reach 30 bcm in the mid-2030s.[79] Thus, approximately half of the natural gas consumption will be met by the OPF in Filyos.

Natural gas to be provided by domestic production in the

Black Sea will contribute significantly to energy security, as there is always a risk of gas cutoff due to regional conflicts, embargoes, sanctions, technical disruptions, or geopolitical tensions.

Natural gas to be provided by domestic production in the Black Sea will contribute significantly to energy security, as there is always a risk of gas cutoff due to regional conflicts, embargoes, sanctions, technical disruptions, or geopolitical tensions. A sustainable economy needs uninterrupted energy, and therefore, due to possible disruptions in energy flow, the country's economy may come to a standstill and affect all areas of life.[80]

The fact that there is no continental shelf problem or terrorist organization threat in the Sakarya Gas Field ensures that natural gas exploration, extraction, production, and other infrastructure activities are carried out quickly and reliably. In addition, one of the critical issues in energy security is that energy exploration and extraction activities are carried out with the national budget and national energy company TPAO. Thus, the produced energy source will be made available in a short time and at reasonable prices. The seismic research and the drilling works carried out in the Black Sea within the body of TPAO are a successful step toward national energy security.

Another possible effect of the Black Sea discovery on national energy security is that it may play the role of an Energy Trade Center (Hub) in natural gas, which Türkiye has aimed to realize for many years. Especially in the 20th century, the issue of access to oil resources and the safety of energy routes were the main reasons for frequent wars and international competition. Natural gas is predicted to replace this competition in the 21st century. In this context, the importance of Türkiye's geopolitical position, which has a central position on natural gas transit routes, is increasing.[81] Thanks to its rapidly increasing daily inflow of natural gas capacity, Türkiye will be one step closer to this dream with domestic production.

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Conclusion

Because natural gas can be used easily in many areas, from electricity generation to industry, from vehicles to heating, and being transferrable by ships in the form of LNG, these are the main factors in the increase in global consumption from year to year. In addition, since coal causes environmental pollution, natural gas is preferred worldwide and in Türkiye. Therefore, this increases the importance of natural gas as a valuable commodity in global trade and international energy security. In this direction, states continue to invest in the global natural gas trade. As seen in this study, natural gas investments are gradually increasing in Türkiye, raising the rate of natural gas consumption in total energy consumption to 26.52%.

In order to determine the natural gas potential in the seas and to convert the discovered natural gas into production, a total of 16 new generation ships, 4 of which are drilling, 2 of which are seismic research ships, and the others are support vessels, are allocated to the inventory of the national oil company TPAO. Thus, Türkiye can successfully conduct natural gas exploration activities with its own national capability. TPAO, which started to reap the rewards of its policy of creating a national energy fleet in a short time, has reached 710 bcm of exploration in the high seas.

In this study, field observation visits took place in the area of the SGFD Project, and interviews were held with experts in the department and the public sector. It is concluded that Filyos is the most logical choice for landing natural gas. The fact that Filyos has the shortest route to the seabed production facility built 2200 meters below the sea and that Türkiye's third largest port built here was a good option for the activities to be carried out in the seas were the determining factors for the construction of SGFD Project in Filyos. Moreover, the fact that the soil improvements have been made earlier within the scope of the Filyos Valley Project behind the port and that there is a sufficient area for the construction of the facilities to be established on land is another important factor. In addition, the fact that the front soil improvements have been made earlier to prevent flooding from the river is seen as another factor. The Environmental Impact Assessment report (EIA) has been received in this direction and is also to be underlined. For this reason, it is concluded that the decision of the Filyos Valley Project area to host the SGFD Project accelerated the production process of the discovered natural gas by about three to four years.

The EIA report prepared for the SGFD Project predicts that the project will remain operational for 25 to 40 years.[82] The Filyos OPF, built within the scope of the SGFD Project, will produce ten mcm of natural gas per year within the scope of Phase 1. Within

the scope of Phase 2, this figure is foreseen as 40 mcm/day in total. This corresponds to an average of 15 bcm of natural gas production annually. Suppose an additional 40 mcm/day of natural gas production is realized within the scope of Phase-3 and Phase-4 in the mid-2030s. In that case, approximately half of the natural gas consumed by Türkiye can be obtained from the Filyos OPF with domestic production.

A total of 8000 people work within the project's scope, of which 2500 are at sea and 5500 are on land. It has also been observed that this number has occasionally increased to 10,000, depending on the intensity of the work. This leads to both economic activities in the region and boosts employment. Thanks to the interviews held with the stakeholders who have an important role in Zonguldak and its region and with the people living in the villages around the SGFD Project, it has been observed that they are generally satisfied with the activities carried out in line with the project and they have great expectations for the future. There is a perception that the fate of Zonguldak, which has been giving immigration for many years, will be reversed with the discovery of natural gas. It is understood that the shaping of this perception is thanks to the fact that young people living in the region have high employment opportunities in construction or other services within the project's scope, in accordance with their qualifications and expertise. In fact, almost all of the housewives in the surrounding villages work in the service sectors within the scope of the project. Moreover, it is understood that sub-industry sectors will also emerge depending on natural gas. For example, it has been observed that Tosyalı Holding has started the construction site to establish a fertilizer factory on the west side of Filyos Stream. Similar factories may also be established in this region in the future because there is sufficient space. In addition, the fact that the region has land, sea, railway, and airway (intermodal transportation) opportunities will ensure that the industrial establishments planned to be established in this region have logistically appropriate conditions.

With the rapid increase in consumption in recent years, Türkiye has reached a natural gas consumption of over 50 bcm per year. Increasing demand and foreign dependency have made it necessary to develop national policies in terms of energy supply security and to conduct exploration studies on potential resources. In accordance with this purpose, Türkiye has been implementing a multi-faceted energy policy to establish natural gas supply security. So, Türkiye has diversified the number of natural gas source countries it imports. It has built two land LNG terminals and bought three FSRUs to import natural gas via LNG. Two underground natural gas storages with a total capacity of 10 bcm, one in Silivri and the other in Tuz Gölü, were built to ensure uninterrupted consumption in extraordinary situations or harsh winter conditions. In addition, by almost doubling the daily natural gas input capacity of consumption, Türkiye aims to not only establish natural gas supply security but also become a country that can export surplus consumption.

After the Middle East, the Eurasian region is the richest in hydrocarbon resources. The fact that the Black Sea is located in the transition region to Europe, which is one of the most energy-consuming regions in the world, and even has the potential to reduce

the dependence on Russia in this transit route increases the importance of the existing geopolitical and geostrategic position of Türkiye.[83] Especially during the Cold War period, the Black Sea was a point of mutual tension between NATO and the Warsaw Pact as a part of Russia's containment policy from the south. However, in the changing conditions after the collapse of the USSR, Türkiye started to regard the Black Sea as a tool to develop mutual cooperation between the countries neighboring the Black Sea in foreign policy.[84] It should not be forgotten that the possibility of Türkiye becoming a hub in energy has gained momentum with the paradigm shift in foreign policy after the Cold War. This approach based on regional cooperation has made Türkiye a more stable and reliable route in the transit of both energy and goods, thanks to the investments and policies implemented in the energy sector, especially in the last 20 years.

Due to the Ukraine-Russia war, the natural gas flow in many pipelines, especially the Nord Stream lines, was stopped or interrupted. Thus, Türkiye, which imports natural gas from many countries, has strengthened its geostrategic position as a reliable and stable country. Türkiye is one of the countries where Europe can bypass Russia and make reliable and cooperation in energy supply. The investment made in the Southern Gas Corridor is a symbolic pipeline of this mutual trust.[85] However, for the investments to be made in the energy corridor, it is necessary to decrease the political tensions seen between Türkiye and the E.U. in recent years and to increase the financial relations. The geostrategic position of Türkiye, which wants to be a determinant in the natural gas market, is quite suitable for this purpose.

The possibility of Türkiye becoming a hub in energy has gained momentum with the paradigm shift in foreign policy after the Cold War. This approach based on regional cooperation has made Türkiye a more stable and reliable route in the transit of both energy and goods, thanks to the investments and policies implemented in the energy sector, especially in the last 20 years.

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Endnotes

1 Ali Yıldırım and Hasan Şimşek, *Sosyal Bilimlerde Nitel Araştırma Yöntemleri* (Ankara: Seçkin Yayıncılık, 2008).
2 Niyazi Karasar, *Bilimsel Araştırma Yöntemi: Kavramlar İlkeler Teknikler* (Ankara: Nobel Akademik Yayıncılık, 1999),162.
3 Şener Büyüköztürk, Ebru Kılıç Çakmak, Özcan Erkan Akgün, Şirin Karadeniz and Funda Demirel (*Eğitimde Bilimsel Araştırma Yöntemleri*. PEGEM Akademi, 2022).
4 Ali Baltacı, "Nitel Veri Analizinde Miles-Huberman Modeli". *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 3, pg. 1 (2017): 8.
5 Darren McCauley, *Energy Justice: Re-Balancing the Trilemma of Security, Poverty and Climate Change* (New York, NY: Springer Berlin Heidelberg, 2017): 30.
6 Mustafa İlbaş, *Enerji-Politik Dünya ve Türkiye* (Ankara: Berikan Yayınevi, 2014): 17.
7 Velichka Milina, "Energy Security and Geopolitics". *Connections* 6, pg. 4 (2007): 29.
8 Şeref Çetinkaya, "Türkiye'nin Enerji Güvenliğinin Sağlanması: Bir Ulusal Güvenlik Meselesi". *Karadeniz Uluslararası Bilimsel Dergi* 43 (2019): 213.
9 Ilhan Ozturk "Energy Dependency and Energy Security: The Role of Energy Efficiency and Renewable Energy Sources." The Pakistan Development Review 52, sy 4 (2013): 314.
10 Yunus Emre Birol, "Doğal Gaz Arz Güvenliği Açısından Avrupa Birliği Ülkeleri ve Türkiye Üzerine Karşılaştırmalı Bir Analiz". *Pamukkale University Journal of Social Sciences Institute* 44 (2021): 454.
11 Yuri Yegerov, "Natural Gas Infrastructure and Energy Security: A Comparison Between the E.U. and China." *Energy Security: Perspectives, Improvement Strategies and Challenges* In, Ed. M. Radovanovic, 171-196. (New York: Nova Science Publishers, 2018): 172.
12 Qodri Febrilian Erahman, and Widodo Wahyu Purwanto,. "Energy Security: A Case Study of Indonesia". *Energy and Environmental Security in Developing Countries* In., Edited by M. Asif, 49-74. (Corrected publication, Cham, Switzerland: Springer, 2021):54.
13 Bert Kruyt, D. P. van Vuuren, H. J. M. de Vries, and H. Groenenberg, "Indicators for Energy Security". *Energy Policy* 37, pg. 6 (2009): 2167.
14 Kester, Johannes *The Politics of Energy Security: Critical Security Studies, New Materialism and Governmentality* (London; New York, NY: Routledge, Taylor & Francis Group, 2018):18
15 Bert Kruyt, D. P. van Vuuren, H. J. M. de Vries, and H. Groenenberg, "Indicators for Energy Security". *Energy Policy* 37, pg. 6 (2009): 2169.
16 Kamer Kasım, "Türkiye-AB İlişkilerinde Kıbrıs Sorunu". *Avrupa Birliği'nin Küresel ve Bölgesel Politikaları* In, Edited by Mehmet Dalar and İlhan Sağsen, 187-205, (Nobel Yayınları: Ankara, 2022): 201.
17 Michael J. Bradshaw, "Global Energy Dilemmas: A Geographical Perspective." *The Geographical Journal*, 176, pg. 4 (2010): 276.
18 Phebe Asantewaa Owusu, and Samuel Asumadu-Sarkodie, "A Review of Renewable Energy Sources, Sustainability Issues and Climate Change Mitigation." *Cogent Engineering* 3, pg. 1 (2016): 3
19 Kester, Johannes *The Politics of Energy Security: Critical Security Studies, New Materialism and Governmentality* (London; New York, NY: Routledge, Taylor & Francis Group, 2018):23
20 European Commission. *EU Green Finance Taxonomy* (Sy 2021/2139). Brussels: European Commission, 29,41.
21 Frederic Simon, *Parliament Backs E.U. Plan to Award' Green' Label for Gas, Nuclear Investments,* 2022.
22 İdris Demir, *Küresel Enerji Jeopolitiğinde Gaz İhraç Eden Ülkeler Forumu* (Bursa: Dora, 2015): 2.
23 GAZBİR 2022. *2021 Doğal Gaz Dağıtım Sektörü Raporu.*
24 B.P. *B.P. Statistical Review of World Energy 2020* (Statistical Review of World Energy, 69th edition, 2020): 15
25 Robert U. Ayres, Hal Turton and Tom Casten, "Energy Efficiency, Sustainability, and Economic Growth." *Energy* 32, 5 (2007): 634.
26 Bayram Aydin, "Kalkınma Literatüründen Hareketle Enerji-Büyüme İlişkisi". *Finans Ekonomi ve Sosyal Araştırmalar Dergisi* 6, pg. 1 (2021): 3.
27 Murat Aykiri, "Enerjide Dışa Bağımlılık ve Sağlıklı Büyüme: Türkiye Örneği". *Aydın İktisat Fakültesi Dergisi* 3, pg. 1 (2018): 54.
28 Selim İnançli and Aylin Aki, "The Empirical Analysis of the Relationship Between Energy Imports and Renewable Energy in Turkey." *Econder International Academic Journal* 4, pg. 2 (2020): 554.
29 Doğan Uysal, Kubilay Çağrı Yilmaz, and Taner Taş, "Enerji İthalatı ve Cari Açık İlişkisi: Türkiye Örneği". *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi* 3, 1 (2015): 68.
30 Saltuk Ağıralioğlu, and Necati Ağıralioğlu, "Türkiye'de Enerji ve Politikaları". *Takvim-i Vekayi* 8, pg. 33 (2020): 174.
31 TCMB. *TCMB - Ödemeler Dengesi İstatistikleri* 2022.
32 Robert U. Ayres, Hal Turton and Tom Casten, "Energy Efficiency, Sustainability, and Economic Growth." *Energy* 32, 5 (2007): 635.
33 Doğanay, Hayati and Coşkun, Ogün. *Enerji Kaynakları* (Ankara: PEGEM Akademi, 2017): 183.
34 Mustafa İlbaş, *Enerji-Politik Dünya ve Türkiye* (Ankara: Berikan Yayınevi, 2014): 37.
35 Velichka Milina, "Energy Security and Geopolitics". *Connections* 6, pg. 4 (2007): 27.
36 David Manley, David Mihalyi and Patrick R. P. Heller, "National Oil Companies Are Economic Giants." *Finance and Development,*2019.
37 İdris Demir, *Uluslararası Petrol Politikaları, Piyasaları, Fiyatları* (Bursa: Dora, 2017): 102-104.
38 Joseph A. Pratt, "Exxon and the Control of Oil." *The Journal of American History* 99, pg. 1 (2012): 149.
39 David G. Victor, "National Oil Companies and the Future of the Oil Industry". *Annual Review of Resource Economics* 5 (2013): 446.
40 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 34.
41 Mustafa İlbaş, *Enerji-Politik Dünya ve Türkiye* (Ankara: Berikan Yayınevi, 2014): 21.
42 B.P. *B.P. Statistical Review of World Energy 2020* (Statistical Review of World Energy, 69th edition, 2020): 10.
43 IEA. *World Energy Balances: Overview*.
44 IGU. *IGU World LNG Report*. (London: The International Gas Union, 2022): 12.
45 TPAO. *Petrol ve Doğal Gaz Sektör Raporu.* (Ankara: TPAO Strateji Geliştirme Daire Başkanlığı, 2021): 31.
46 Sarah Ladislaw and Philippe Benoit, *Energy, and Development: Providing Access and Growth* (Center for Strategic and International Studies (CSIS), 2017): 4.
47 T.C. Yatırım Ofisi. *Enerji* 2021.
48 TPAO. *Petrol ve Doğal Gaz Sektör Raporu.* (Ankara: TPAO Strateji Geliştirme Daire Başkanlığı, 2021): 43.
49 Nuran Erkul Kaya, *Türkiye'nin Enerji Haritasında 'Yeşil'in Payı Artıyor*, 2021.
50 TEIAS. *Türkiye Elektrik Üretim-İletim İstatistikleri* TEIAS Institutional, 2022.

51 T.C. Enerji Bakanlığı, *Türkiye Ulusal Enerji Planı* (Republic of Türkiye Ministry of Energy and Natural Resources, 2022): 20.
52 EPDK 2022. *Doğal Gaz Piyasasi 2021 Yili Sektör Raporu.* (Ankara: EPDK, 2022): 13.
53 EPDK 2023b. *Doğal Gaz Piyasası Aylık Sektör Raporu Listesi* (T.C. Enerji Piyasası Düzenleme Kurulu 2023).
54 EPDK 2023b. *Doğal Gaz Piyasası Aylık Sektör Raporu Listesi* (T.C. Enerji Piyasası Düzenleme Kurulu 2023).
55 EPDK 2023a. *2022 Yılı Elektrik Piyasası Aralık Ayı Sektör Raporu* (T.C. Enerji Piyasası Düzenleme Kurumu 2023).
56 TPAO. *Petrol ve Doğal Gaz Sektör Raporu.* (Ankara: TPAO Strateji Geliştirme Daire Başkanlığı, 2021).
57 EPDK 2023b. *Doğal Gaz Piyasası Aylık Sektör Raporu Listesi* (T.C. Enerji Piyasası Düzenleme Kurulu 2023).
58 BOTAS. *BOTAS 2021 Almanak*. Ankara: BOTAŞ Boru Hatları ile Petrol Taşıma A.Ş.): 17-18.
59 Bezen Balamir Coskun and Richard Carlson, "New Energy Geopolitics: Why does Turkey Matter?". *Insight Turkey* 12, pg. 3 (2010): 208.
60 Remziye Yılmaz Bozkus, "Main Determinants of Turkey's Foreign Oil and Natural Gas Strategy." *Journal of Research in Economics, Politics & Finance* 3, pg. 3 (2018): 126.
61 Aykiri, Murat. "Enerjide Dışa Bağımlılık ve Sağlıklı Büyüme: Türkiye Örneği". *Aydın İktisat Fakültesi Dergisi* 3, pg. 1 (2018): 59.
62 MENR *Turkey's Ministry of Energy and Natural Resources (MENR) Strategic Report* (Ministry of Energy and Natural Resources, 2015): 23
63 Mert Bilgin, "Turkey's Energy Strategy: Synchronizing Geopolitics and Foreign Policy with Energy Security." *Insight Turkey* 17, *2* (2015): 69.
64 T.C. Enerji Bakanlığı 2019. *T.C. Enerji ve Tabii Kaynaklar Bakanlığı 2019-2023 Stratejik Planı.* (Ankara: T.C. Enerji Bakanlığı, 2019): 23.
65 M. Fatih Bilal Alodali, , and Sefa Usta, "Enerji Diplomasisi ve Türkiye". *Karamanoğlu Mehmetbey Üniversitesi Sosyal ve Ekonomik Araştırmalar Dergisi* 19, pg. 33 (2017): 165.
66 TPAO. *Petrol ve Doğal Gaz Sektör Raporu.* (Ankara: TPAO Strateji Geliştirme Daire Başkanlığı, 2021): 22.
67 T.C. Strateji ve Bütçe Başkanlığı. *2023 Yılı Yatırım Programı*. (Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanliği 2023).
68 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 126.
69 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 126.
70 Mark J. Kaiser, *The Offshore Pipeline Construction Industry: Activity Modeling and Cost Estimation in the U.S. Gulf of Mexico*. (Cambridge, MA: Gulf Professional Publishing, 2020): 371.
71 Türkiye Petrolleri. *Sakarya Gaz Sahasındaki Türkali-2 tespit Kuyusunda Gerçekleştirilen İlk Kuyu Akış Testi*, 2021.
72 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 102.
73 TP-OTC. *Environmental And Social Impact Assessment Report, Non-Technical Summary*, (Company Doc. No. SC26-OTC-PRJ-EN-REP-000036,2022).
74 TP-OTC. *Environmental And Social Impact Assessment Report, Non-Technical Summary*, (Company Doc. No. SC26-OTC-PRJ-EN-REP-000036,2022): 15.
75 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 87.
76 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 190.
77 Remziye Yılmaz Bozkus, "Main Determinants of Turkey's Foreign Oil and Natural Gas Strategy." *Journal of Research in Economics, Politics & Finance* 3, pg. 3 (2018): 115.
78 GAZBIR. 2023. *2022 Doğal Gaz Dağıtım Sektörü Raporu.*
79 İshak Turan and Şaban Çelikoğlu, *Enerji Güvenliği Açısından Sakarya Gaz Sahası*, (Ankara: Berikan Yayınevi, 2023): 119.
80 Şeref Çetinkaya "Türkiye'nin Enerji Güvenliğinin Sağlanması: Bir Ulusal Güvenlik Meselesi". *Karadeniz Uluslararası Bilimsel Dergi* 43 (2019): 213.
81 Fahri Akbaş and Emre Ürün "Enerji Güvenliği: Bölgesel Enerji Merkezi Türkiye". *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, Özel Sayısı (2016): 109.
82 ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu* (Ankara: Armada Eğitim Danışmanlık, 2021): 34.
83 Sertif Demir, "Karadeniz'in Güvenliğini Yeniden Düşünmek". *Karadeniz Araştırmaları* 35, (2012): 23.
84 Giray Saynur Derman, "Security Policy of Turkey and Russia in the Black Sea Basin." *Karadeniz Araştırmaları*, 30, (2010): 3.
85 D Ala'Aldeen, K. Palani, G. Babunashvili, and J. Balisdell, *Europe and Turkey: Between Energy Demand and Supply*. (Middle East Research Institute, 2018): 2.

References

Ağıralioğlu, Saltuk and Ağıralioğlu, Necati. "Türkiye'de Enerji ve Politikaları". *Takvim-i Vekayi* 8, pg. 33 (2020): 166-198.

Akbaş, Fahri and Ürün, Emre. "Enerji Güvenliği: Bölgesel Enerji Merkezi Türkiye". *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, Özel Sayısı (2016): 103-113.

Ala'Aldeen, D., Palani, K., Babunashvili, G., and Balisdell, J. *Europe and Turkey: Between Energy Demand and Supply*. Middle East Research Institute, 2018: 1-6. Retrieved January 31, 2024, from Middle East Research Institute website: https://www.jstor.org/stable/resrep19961.3.

Alodali, M. Fatih Bilal, and Usta, Sefa. "Enerji Diplomasisi ve Türkiye". *Karamanoğlu Mehmetbey Üniversitesi Sosyal ve Ekonomik Araştırmalar Dergisi* 19, pg. 33 (2017): 163-168.

Aydin, Bayram. "Kalkınma Literatüründen Hareketle Enerji-Büyüme İlişkisi". *Finans Ekonomi ve Sosyal Araştırmalar Dergisi* 6, pg. 1 (2021): 1-13.

Aykiri, Murat. "Enerjide Dışa Bağımlılık ve Sağlıklı Büyüme: Türkiye Örneği". *Aydın İktisat Fakültesi Dergisi* 3, pg. 1 (2018): 50-67.

Ayres, Robert U., Turton, Hal, and Casten, Tom. "Energy Efficiency, Sustainability and Economic Growth". *Energy* 32, 5 (2007): 634-648.

Baltacı, Ali. "Nitel Veri Analizinde Miles-Huberman Modeli". *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 3, pg. 1 (2017): 1-14.

Berg, Bruce L., and Lune, Howard *Sosyal Bilimlerde Nitel Araştırma Yöntemleri* (E. C. Aybek, Çev.). Konya: Eğitim Yayınevi, 2019.

Bilgin, Mert. "Turkey's Energy Strategy: Synchronizing Geopolitics and Foreign Policy with Energy Security". *Insight Turkey* 17, *2* (2015): 67-81.

Birol, Yunus Emre. "Doğal Gaz Arz Güvenliği Açısından Avrupa Birliği Ülkeleri ve Türkiye Üzerine Karşılaştırmalı Bir Analiz". *Pamukkale University Journal of Social Sciences Institute* 44 (2021): 451-467.

BOTAS. *BOTAS 2021 Almanak*. Ankara: BOTAŞ Boru Hatları ile Petrol Taşıma A.Ş., Retrieved January 31, 2024, from BOTAŞ Boru Hatları ile Petrol Taşıma A.Ş. website: https://www.botas.gov.tr/uploads/galeri/242808-botas-2021-almanak.pdf

B.P. *B.P. Statistical Review of World Energy 2020*. Statistical Review of World Energy, 69th edition, 2020. Retrieved August 21, 2023, from https://enerji.mmo.org.tr/wp-content/uploads/2020/07/bp-stats-review-2020-full-report.pdf.

Bozkus, Remziye Yılmaz. "Main Determinants of Turkey's Foreign Oil and Natural Gas Strategy". *Journal of Research in Economics, Politics & Finance* 3, pg. 3 (2018): 114-132.

Bradshaw, Michael J. "Global Energy Dilemmas: A Geographical Perspective". *The Geographical Journal*, 176, pg. 4 (2010): 275-290.

Büyüköztürk, Şener, Kılıç Çakmak, Ebru, Akgün, Özcan Erkan, Karadeniz, Şirin and Demirel, Funda. *Eğitimde Bilimsel Araştırma Yöntemleri*. PEGEM Akademi, (2022).

Coskun, Bezen Balamir and Carlson, Richard. "New Energy Geopolitics: Why Does Turkey Matter?". *Insight Turkey* 12, pg. 3 (2010): 205-220.

ÇED. *Sakarya Gaz Sahasi Denizalti Üretim Tesisleri, Denizalti Nakil Hatlari ve Kara Doğalgaz İşleme Tesisi Entegre Projesi Nihai ÇED Raporu,* 2021. Ankara: Armada Eğitim Danışmanlık. Retrieved January 31, 2024, from Armada Eğitim Danışmanlık website: http://eced.csb.gov.tr/jsp/ek1/33048#

Çetinkaya, Şeref. "Türkiye'nin Enerji Güvenliğinin Sağlanması: Bir Ulusal Güvenlik Meselesi". *Karadeniz Uluslararası Bilimsel Dergi* 43 (2019): 208-215.

Demir, İdris. *Küresel Enerji Jeopolitiğinde Gaz İhraç Eden Ülkeler Forumu*. Bursa: Dora, 2015.

Demir, İdris. *Uluslararası Petrol Politikaları, Piyasaları, Fiyatları*. Bursa: Dora, 2017.

Demir, Sertif. "Karadeniz'in Güvenliğini Yeniden Düşünmek". *Karadeniz Araştırmaları* 35, (2012): 19-50.

Derman, Giray Saynur. "Security Policy of Turkey and Russia in the Black Sea Basin." *Karadeniz Araştırmaları*, 30, (2010): 1-13.

Doğanay, Hayati and Coşkun, Ogün. *Enerji Kaynakları*. Ankara: PEGEM Akademi, 2017

EPDK 2022. *Doğal Gaz Piyasasi 2021 Yili Sektör Raporu*. Ankara: EPDK. Retrieved January 31, 2024, from EPDK website: file:///Users/ishakturan/Downloads/_PortalAdmin_Uploads_Content_FastAccess_Ddp_yayin_rapor_2012a8322916.pdf.

EPDK 2023a. 2022 Yılı Elektrik Piyasası Aralık Ayı Sektör Raporu. T.C. Enerji Piyasası Düzenleme Kurumu, Retrieved January 31, 2024, from https://www.epdk.gov.tr/Detay/Icerik/3-0-23-3/elektrikaylik-sektor-raporlar.

EPDK 2023b. *Doğal Gaz Piyasası Aylık Sektör Raporu Listesi.* T.C. Enerji Piyasası Düzenleme Kurulu. Retrieved January 31, 2024, from https://www.epdk.gov.tr/Detay/Icerik/3-0-95/dogal-gazaylik-sektor-raporu.

Erahman, Qodri Febrilian and Purwanto, Widodo Wahyu. "Energy Security: A Case Study of Indonesia". In. *Energy and Environmental Security in Developing Countries, Edited by* M. Asif, 49-74. Corrected publication, Cham, Switzerland: Springer, 2021.

European Commission. *EU Green Finance Taxonomy* (Sy 2021/2139). Brussels: European Commission. Retrieved January 31, 2024, from European Commission website: https://www.euractiv.com/wp-content/uploads/sites/2/2022/01/draft-CDA-31-12-2021.pdf

GAZBİR 2022. *2021 Doğal Gaz Dağıtım Sektörü Raporu,* Retrieved January 31, 2024, from https://www.gazbir.org.tr/uploads/page/2021_Yili_Dogal_Gaz_Sektoor_Raporu.pdf.

GAZBIR. 2023. *2022 Doğal Gaz Dağıtım Sektörü Raporu,* Retrieved January 31, 2024, from https://www.gazbir.org.tr/GAZBIR-2022-Yili-Dogal-Gaz-Dagitim-Sektoru-Raporu/.

İnançli, Selim and Aki, Aylin. "The Empirical Analysis of the Relationship Between Energy Imports and Renewable Energy in Turkey." *Econder International Academic Journal* 4, pg. 2 (2020): 551-564.

IEA. *World Energy Balances: Overview*. Retrieved June 08, 2022, from IEA website: https://www.iea.org/reports/world-energy-balances-overview/world

IGU. *IGU World LNG Report 2022*. London: The International Gas Union. Retrieved January 31, 2024, from https://www.igu.org/resources/world-lng-report-2022/

İlbaş, Mustafa. Enerji-Politik Dünya ve Türkiye. Ankara: Berikan Yayınevi, 2014.

Kaiser, Mark J. *The Offshore Pipeline Construction Industry: Activity Modeling and Cost Estimation in the U.S. Gulf of Mexico*. Cambridge, MA: Gulf Professional Publishing, 2020.

Karasar, Niyazi. *Bilimsel Araştırma Yöntemi: Kavramlar İlkeler Teknikler*. Ankara: Nobel Akademik Yayıncılık, 1999.

Kasım, Kamer. "Türkiye-AB İlişkilerinde Kıbrıs Sorunu". In. *Avrupa Birliği'nin Küresel ve Bölgesel Politikaları*. Edited by Mehmet Dalar and İlhan Sağsen, 187-205, Nobel Yayınları: Ankara, 2022.

Kaya, Nuran Erkul, *Türkiye'nin Enerji Haritasında 'Yeşil'in Payı Artıyor* 2021. Retrieved January 31, 2024, AA Energy website: https://www.aa.com.tr/tr/ekonomi/turkiyenin-enerji-haritasinda-yesilin-payi-artiyor/2280401

Kester, Johannes *The Politics of Energy Security: Critical Security Studies, New Materialism and Governmentality*. London; New York, NY: Routledge, Taylor & Francis Group, (2018).

Kruyt, Bert, van Vuuren, D. P., de Vries, H. J. M. and Groenenberg, H. "Indicators for Energy Security". *Energy Policy* 37, pg. 6 (2009): 2166-2181.

Ladislaw, Sarah, and Benoit, Philippe. *Energy and Development: Providing Access and Growth*. Center for Strategic and International Studies (CSIS), 2017. Retrieved January 31, 2024, from Center for Strategic and International Studies (CSIS) website: https://www.jstor.org/stable/resrep23299.

Manley, David, Mihalyi, David and Heller, Patrick R. P. "National Oil Companies Are Economic Giants." *Finance and Development,2019.* Retrieved January 14, 2023, from IMF website: https://www.imf.org/en/Publications/fandd/issues/2019/12/national-oil-companies-need-more-transparency-manley

McCauley, Darren. *Energy Justice: Re-Balancing the Trilemma of Security, Poverty and Climate Change*. New York, NY: Springer Berlin Heidelberg, 2017.

MENR *Turkey's Ministry of Energy and Natural Resources (MENR) Strategic Report*, 2015. Retrieved January 30, 2024, from www.energy.gov.tr: Ministry of Energy and Natural Resources.

Milina, Velichka. "Energy Security and Geopolitics". *Connections* 6, pg. 4 (2007): 25-44.

Noreng, Øystein. "National Oil Companies and Their Government Owners: The Politics of Interaction and Control." *The Journal of Energy and Development* 19 pg. 2 (1994): 197-226.

Owusu, Phebe Asantewaa and Asumadu-Sarkodie, Samuel. "A Review of Renewable Energy Sources, Sustainability Issues and Climate Change Mitigation". *Cogent Engineering* 3, pg. 1 (2016): 1-14.

Ozturk, Ilhan "Energy Dependency, and Energy Security: The Role of Energy Efficiency and Renewable Energy Sources." *The Pakistan Development Review* 52, sy 4 (2013): 309-330.

Pratt, Joseph A. "Exxon and the Control of Oil". *The Journal of American History* 99, pg. 1 (2012): 145-154.

Simon, Frederic. *Parliament Backs E.U. Plan to Award' Green' Label for Gas, Nuclear Investments,* 2022. Retrieved October 15, 2022, from www.euractiv.com website: https://www.euractiv.com/section/energy-environment/news/parliament-backs-eu-plan-to-award-green-label-for-gas-nuclear-investments/

T.C. Enerji Bakanlığı 2019. *T.C. Enerji ve Tabii Kaynaklar Bakanlığı 2019-2023 Stratejik Planı*. Ankara: T.C. Enerji Bakanlığı. Retrieved January 18, 2023, from T.C. Enerji Bakanlığı website: https://sp.enerji.gov.tr/ETKB_2019_2023_Stratejik_Plani.pdf

T.C. Enerji Bakanlığı 2022. *Türkiye Ulusal Enerji Planı*. Republic of Türkiye Ministry of Energy and Natural Resources. Retrieved January 14, 2023, from Republic of Türkiye Ministry of Energy and Natural Resources,website:https://enerji.gov.tr//Media/Dizin/EIGM/tr/Raporlar/TUEP/T%C3%BCrkiye_Ulusal_Enerji_Plan%C4%B1.pdf

T.C. Strateji ve Bütçe Başkanlığı 2023. *2023 Yılı yatırım Programı*. Türkiye Cumhuriyeti Cumhurbaşkanlığı Strateji ve Bütçe Başkanliği. Retrieved January 14, 2023, from https://www.sbb.gov.tr/wp-content/uploads/2023/01/2023-Yili-Yatirim-Programi-15012023.pdf

T.C. Yatırım Ofisi. *Enerji*. Retrieved September 11, 2021, from https://www.invest.gov.tr/tr/sectors/sayfalar/energy.aspx

TCMB. *TCMB - Ödemeler Dengesi İstatistikleri*. Retrieved October 14, 2023, from https://www.tcmb.gov.tr/wps/wcm/connect/TR/TCMB+TR/Main+Menu/Istatistikler/Odemeler+Dengesi+ve+Ilgili+Istatistikler/Odemeler+Dengesi+Istatistikleri/

TEIAS. *Türkiye Elektrik Üretim-İletim İstatistikleri* 2022. [TEIAS Institutional]. Retrieved November 07, 2022, from https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri

TPAO. *Petrol ve Doğal Gaz Sektör Raporu 2021*. Ankara: TPAO Strateji Geliştirme Daire Başkanlığı. Retrieved January 30, 2023 from https://www.tpao.gov.tr/file/2208/2021-sektor-raporu-95662fe47ebd-9c5f.pdf

TP-OTC. *Environmental And Social Impact Assessment Report, Non-Technical Summary*, Company Doc. No. SC26-OTC-PRJ-EN-REP-000036,2022, Retrieved January 30, from https://www.tpao.gov.tr/file/2210/sakarya-gas-field-development-project-non-technica-1062635810a6d7ca9.pdf

Turan, İshak and Çelikoğlu, Şaban. *Enerji Güvenliği Açısından Sakarya Gaz Sahası*, Ankara: Berikan Yayınevi, 2023.

Türkiye Petrolleri. *Sakarya Gaz Sahasındaki Türkali-2 tespit Kuyusunda Gerçekleştirilen İlk Kuyu Akış Testi*. Retrieved January 30 from https://www.tpao.gov.tr/basin-bultenleri

Uysal, Doğan, Yilmaz, Kubilay Çağrı and Taş, Taner. "Enerji İthalatı ve Cari Açık İlişkisi: Türkiye Örneği". *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi* 3, 1 (2015): 63-78.

Yegerov, Yuri. "Natural Gas Infrastructure and Energy Security: A Comparison Between the E.U. and China". In *Energy Security: Perspectives, Improvement Strategies, and Challenges,* Ed. M. Radovanovic, 171-196. New York: Nova Science Publishers, 2018.

Victor, David G. "National Oil Companies and the Future of the Oil Industry". *Annual Review of Resource Economics* 5 (2013): 445-462.

Yıldırım, Ali and Şimşek, Hasan. *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Ankara: Seçkin Yayıncılık, 2008.

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