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Natural Gas Discoveries and Proposed Gas Transport Pipelines in the Mediterranean Basin.

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Abstract:

This study tries to highlight the gas discoveries in the Eastern Mediterranean region in addition to the current and proposed energy transmission pipelines, which will draw a map of energy in the region and show what the international conflict is from an energy perspective. A series of massive natural gas discoveries in the Levantine Basin changed the strategies of the Eastern Mediterranean region. Natural gas discoveries are likely to benefit the entire region, whether by meeting domestic gas needs and exporting the surplus from these reserves or through transport pipeline projects and gas liquefaction terminals. All options in the eastern Mediterranean to develop offshore gas reserves remain wide open and depend on political developments, security, and economic conditions that are rapidly developing, and finding approaches such as everyone is winning and not excluding any Party in the region from the benefit of these resources.

Keywords — **Gas Discoveries, Eastern Mediterranean, Gas Transport Pipelines, Economic Peace.**

1. INTRODUCTION

Natural gas is a mixture of hydrocarbons components, mostly methane, less ethane, propane, butane, and other gaseous substances such as carbon dioxide, nitrogen, hydrogen sulfide, and, in some cases, helium. Natural gas is very similar in composition to other fossil fuels such as petroleum. Where they form in the same natural conditions, at depths ranging from 1000 to 6000 meters (at temperatures ranging between 60 to 150 degrees Celsius) produce oil, while those buried deeper and at higher temperatures produce natural gas. Natural gas consists of plankton, which are microscopic organisms that have died and accumulated in the layers of the oceans and Earth. Over thousands of years, pressure and heat produced by sedimentary layers have transformed these organic materials into natural gas.

Natural gas is one of the best fuels used and it is a non-renewable energy source as its quantities decrease over time as a result of its intensive use due to the features that distinguish it from other

Natural gas combusts completely, generating carbon dioxide instead of toxic carbon monoxide. Natural gas contains a small percentage of impurities and plankton that can be removed smoothly and at a low cost. When natural gas is burned at high temperatures in order to produce electrical energy, it produces small quantities of nitrogen oxides, but the proportion of thermal pollution is minimal due to the quality of internal combustion. Natural gas does not require transformational processes and stages. Natural gas is fast burning and clean [1].

1.2 AN OUTLOOK OF THE WORLD NATURAL GAS MARKET

In the future of energy predicted, the share of natural gas in the global energy market will clearly increase. Even though oil demand is modestly growing, its market share remains steady. In the early decades of the 21st century, coal is undoubtedly the loser among the sources of energy, and its limited market share in favour of natural gas would soon become lost. Although nuclear energy will grow rapidly in this prediction, its share in the

global energy market over the next decades will be modest. Although nuclear energy offers a carbon-free energy source, it can be possible for them all to be constrained by high capital costs, nuclear waste, safety, and security issues. Hydropower is still insignificant in the global sense, as are emerging power sources.

With this trend, natural gas is becoming a winner as a result of the rising energy demand shares by gaining half the projected rise over the next 20 years. Thus, natural gas will remain the fastest-growing primary energy source.

Al-Attiyah Energy Corporation's report states: in 2019 there was a rapid growth in the natural gas sector at rates above that of a decade and helped by a domestic boom in China and the US, as well as the expansion of global gas trade to a variety of Asian markets. However, the scene began very differently in 2020 when global demand for oil deteriorated due to the economic closure imposed to control the Corona Virus pandemic in every nation in the world, but when we look past current energy imbalances the future gas environment will look brighter. Last March, crude oil fell, along with other markets, while the natural gas market maintained a better position.

According to the IEA, the global gas use, which is advancing by 2.1 percent a year, in 2015, has been expected to grow to 3.68 trillion cubic meters and cross 4.78 tons of cubic meters by 2030. By 2035, the only fossil fuel which its share will rise in global energy sources is projected to be natural gas [2].

1.2.1 GAS MARKETS FLEXIBILITY IN LIGHT OF COVID-19 PANDEMIC

International LNG trading has given the gas markets much-required flexibility to respond to the steep drop in pandemic demand, new IEA finds. The International Energy Agency said that liquefied natural gas (LNG) remains essential to ensuring global natural gas supply protection and played an integral role to adapt the sector to the exceptional decline in global gas demand during the first semester of 2020.

LNG continues to play an important role in this downturn to balance global gas markets and provide flexibility to respond to volatility in demand. With global demand declining unprecedentedly during the first half of the year, gas producers and exporters have been forced to provide flexibility for supply adjustment. LNG was one of the main components of that modification and, between January and July 2020, monthly global exports decreased by 17 percent.

Global demand for gas dropped by an estimated 4 percent year-on-year in the first half of 2020 due to both the Covid-19 crisis and the unusually warm winter in the northern hemisphere. Most of the decreases in gas use have occurred in developed markets across Europe, North America, and Asia. Together, these markets account for more than 80% of the expected decline in global demand for natural gas in 2020. During the second quarter of 2020, when the global lockout peak occurred, natural gas spot prices in all major gas-consuming regions plummeted to their lowest levels in at least a decade. In the third quarter, however, prices registered strong gains due to changes in supply and demand recovery.

In 2021, demand for natural gas is projected to grow by 3 percent or approximately 130 bcm. However, the recent reappearance of Covid-19 and an extended pandemic have raised concern about the recovery rate in 2021. The global demand for gas is likely to rebound in 2021 driven by the increasingly rising Asian, African, and Middle East markets. More mature markets are expected to gradually rebound, but before 2022 some may not be back to their 2019 levels [3].

1.3 NATURAL GAS RESERVES

Unconventional gas output accounts for up to 60 percent of US gas production, but contributes very little in other areas of the world. According to the International Energy Agency (IEA), conventional and unconventional recoverable resources are of similar size worldwide. The IEA proposes that total reserves that can be extracted can supply natural gas at current consumption rates for 250 years.

The figures in Table 1.1 show that Middle East reserves total proven 79.8 trillion cubic meters, 42.7% of the total global reserves. Europe and Eurasia's reserve amounts to 58.0 trillion cubic meters, 31% of the total. Both regions contain approximately 74% of the proven reserves between them. Otherwise,

there are considerably lower stocks. The reserve is 15.3 trillion cubic meters (8.2%) for the Asia Pacific, 14.2 trillion cubic meters (7.6%) for Africa, 12.1 trillion cubic meters (6.5%) for North America, and 7.7 trillion cubic meters (4.1%) for central and south-American countries. The US is the world's largest natural gas consumer and the pace at which its reserves are consumed is faster than in any other country [4].

The world's proven gas reserves increased by 1.7 Tcm to 198.8 Tcm in 2019. China (2 Tcm) and Azerbaijan (0.7 Tcm) provided the largest increases, although this was primarily driven by a decrease of 1.3 Tcm in Indonesian reserves. Russia (38 Tcm), Iran (32 Tcm), and Qatar (24.7 Tcm) are the countries with the highest reserves. The latest global R / P ratio indicates that the gas reserves accounted for 49.8 years of current supply in 2019. Middle East (108.7 years) and CIS (75.8 years) are the regions with the highest ratio of R / P. See Fig 1.1 [5].

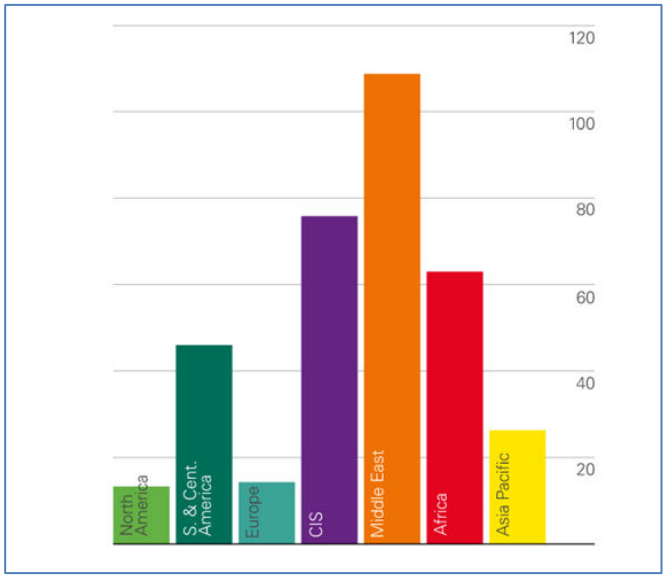

Fig 1. Reserves to production (R/P) ratios (2019 by region) [5].

Table1.1. Global Proven Gas Reserves by Region, 2014 [4].

Region	Total Proved Reserves (Trillion m^3)	Regional Reserves as a Proportion of Global Total (%)	Reserve/Production Ratio (Years)
North America	12.1	6.5	12.8
Central and South America	7.7	4.1	43.8
Europe and Eurasia	58.0	31.0	57.9
Middle East	79.8	42.7	100 years
Africa	14.2	7.6	69.6
Asia Pacific	15.3	8.2	28.7
World	187.1	100.0	54.1

1.4 NATURAL GAS PRODUCTION

More than half of the global rise in 2019 came from the United States, the leading producer of gas followed by Russia, Australia, China, and Iran. The production of domestic gas from the US grew more than 10 per cent, powered by new discoveries in Texas and Pennsylvania shale formations. Moreover, new export capacities of gas and LNG and high electricity demand have helped to improve U.S. gas production. In the Russian Federation (total activity for projects completed in 2018 or began in 2019), and in Australia (total growth of 18%), gas production has steadily continued to increase (total growth) and domestic demand.

Gas production in Europe is continuing to decline (-5.7%) as maintenance and outages reduced output in Norway, and in the Netherlands the production of Gas in Groningen continued to decline (-13%). In Latin America, too, gas production remained very steady, even though Argentina grew 5 percent. World natural gas production, which was (3538.6 bcm) in 2015 increased by 13.3 % (4082 bcm) in 2019 because US domestic gas production rose by more than 10%. North America has the largest

share of production with 1134 bcm about 27.75% followed by CIS countries with 973 bcm (23.8%),The Middle -East with 674 bcm (16,5%) , Asia with 472 bcm (11,5%) , Africa with 241 bcm (5,9%) Europe with 232 bcm (5.6%), Latin America with 202 bcm (5%) and Pacific with 155bcm (3.8%) [6].

1.5 NATURAL GAS CONSUMPTION

Global gas consumption increased in 2019 (+ 2.6%), but at a slower rate than in 2018 (5.1%). In the United States, the largest gas consumer, it grew by 3.1% in 2019, thanks to lower prices and a new share of gas in the energy sector. Growth has been mixed, at 7% in the energy sector, but in residential, commercial, and industrial sectors consumption has been fairly flat. In China, due to the economic slowdown and the easing of the policy in switching from coal to gas, the growth in gas consumption was halved (+ 8.6%).

While consumption increased in the European Union (+ 3.1%), demand rebounded in Spain, Germany, and Italy, as well as in producing countries such as Russia, Australia, Iran, Algeria, and Egypt. In Asia, the decline continued in Japan and South Korea, due to reduced demand from the energy sector (reduced electricity consumption and increased competition from nuclear reactors and renewables) [6].

According to the data in Table 1, the Middle East region has the largest share of gas reserves, 79.8 trillion cubic meters, about 42.7% of global gas reserves, and the figures released for 2019 indicate that the reserve life of gas in the Middle East is about 108 years. As a result, large quantities of natural gas are exported from the Middle East as liquefied natural gas (LNG). Much of this gas is being exported to the Asia Pacific region. Although North America has the largest share of gas production currently, 1134 bcm, about 27% of global production, which has grown by more than 10%, supported by new discoveries in the shale formations in Texas and Pennsylvania, it also has the largest share of consumption in the world, about 1000 bcm.

Countries such as Qatar, Turkmenistan, Norway, Australia, and Algeria have a surplus amount of production, and therefore large quantities for export to several countries such as China, which consume almost twice what they produce. These statistics shown in the figures remain temporary and not final in light of the new discoveries in the regions of the Eastern Mediterranean or the Black Sea, which can change many accounts and policies.

Table 1. 2.Annual Production and Consumption of Natural Gas by Region, 2019.

Region	Annual Production of Natural Gas in 2019 (Billion m^3)	Annual Consumption of Natural Gas in 2019 (Billion m^3)
North America	1134	1005
Central and South America	202	231
Europe	232	552
CIS	973	668
Middle East	674	557
Africa	241	154
Asia Pacific	627	851
Global total	4082	4018

Based on the data contained in the previous fees, we arrive at Table 1.2, as the figures in this table show us the production and consumption of natural gas by global region in 2019. It was the largest regional production in North America with an annual production of 1,134 bcm. Production is balanced by the largest regional consumption, 1005 bcm. Production in Europe and Eurasia was nearly equal to that in North America, with production in Europe and Eurasia reaching 1,220 bcm. Consumption reached 1,105 bcm, and much of this gas was burned in Western Europe even though Russia was also a large consumer. The Middle East was the third largest producer of natural gas in 2019 with 674 bcm In contrast, consumption in the region was only 557 bcm. Significant quantities of natural gas are exported from the Middle East as Liquefied Natural Gas (LNG). Much of this gas is exported to the Asia-Pacific region. Production in the Asia-Pacific region for 2019 was 627 bcm, while consumption was much higher at 851 bcm. Africa produced 241 bcm of natural gas in 2019 but

consumed only 154 bcm. Large quantities of African gas are also exported. Finally, natural gas production in Central and South America was 202.0 bcm, while consumption was 231 bcm.

2. NATURAL GAS DISCOVERIES IN EASTERN MEDITERRANEAN BASIN.

2.1 THE IMPORTANCE OF NATURAL GAS DISCOVERIES IN THE EASTERN MEDITERRANEAN

The vast wealth of hydrocarbons present under the sea in the eastern Mediterranean, which can be compared perhaps to the energy resources of the North Sea, could turn the region into "one of the most important sources of natural gas in the world during the next half-century" [7]. These massive deposits of natural gas, estimated by the US Geological Survey to be somewhere between 122 and 227 trillion cubic feet (plus 1.7 billion barrels of oil), could divert billions of dollars into the coffers of the region. If fully exploited, the profits hold the potential to transform the international energy market, reduce Europe's dependence on Russian gas, boost the economies of the Eastern Mediterranean countries, and reduce electricity shortages and power outages in the region. Major oil discoveries made over the past decade include the gas fields of Aphrodite, Calypso, and Glaucus in Cyprus, Tamar and Leviathan in Israel, and the giant Zohr field in Egypt.

Since 2006, Europe has increasingly regarded Eastern Mediterranean gas as an essential resource with significant potential for economic development, climate change mitigation and carbon dioxide emissions, and reduced reliance on Russian gas supplies. European companies have contributed to gas exploration, while the European Union has largely supported the idea of a new pipeline linking the Israeli and Egyptian fields with Cyprus and Europe. But things may change in the future. Due to the global surplus supply of Liquefied Natural Gas (LNG), the importance of Eastern Mediterranean gas is diminishing for Europe. The eastern Mediterranean gas is also the center of a massive diplomatic struggle, due to differences between Turkey, Greece, and Cyprus over exclusive economic zones (EEZs) and exploration rights. But nevertheless Eastern Mediterranean gas remains extremely important to the countries of the region to enhance energy security and advance their economic development [8].

Since Israel made its first major discovery in 2009, interest in the eastern Mediterranean as a natural gas resource began (See Fig 2.1). The first in a large-scale sequence of natural gas discoveries in the area was the Tamar field off the Israeli coast. In Israel (Leviathan), Cyprus (Aphrodite), and Egypt (Zohr) significant discoveries were subsequently made. In 2010, the United States Geological Survey (USGS) reported that in the Levant Basin, as a base for a significant part of the Eastern Mediterranean, there may be about 122 trillion cubic feet of exposed natural gas deposits. He said that the Levantine Basin could contain up to 1.7 billion barrels of recoverable oil, enabling potential oil exploration [9].

2.2 REGIONAL NATURAL GAS DATA OF THE EASTERN MEDITERRANEAN COUNTRIES

Some countries of Eastern Mediterranean do not use natural gas as fuel (such as Cyprus and Lebanon) and some are essentially self-sufficient in natural gas (such as Israel and Syria) (see Table 2.1), unlike Greece and Turkey, which depend heavily on their needs from Natural gas to imports. Egypt, which possesses vast natural resources for natural gas (Table 1 of the 2014 figures show Egypt as a net natural gas source), started importing natural gas in 2015 to meet large gas demands. Egypt's situation may change in the medium term if its assistance to natural gas is reduced or stopped or its strategy for promoting further production of natural gas is changed. The investment and development of natural gas resources in the region could meet the potential increasing needs of most countries, to do this, many geopolitical obstacles must be overcome and new infrastructure built. Although recent discoveries are relatively large for the region, it is only a small amount at the level of the global reserve. The region's natural gas reserves account for less than 1.5% of the reserves in the world. In 2014, regional production was less than 2% of world production, while consumption was more than 3% [9].

Table 2. 1 Regional Natural Gas Data 2014 [9].

Country	Reserves (bcf)	Production (bcf)	Consumption (bcf)	Net Imports (bcf)
Cyprus	0	0	0	0
Egypt	76,562	1,723	1,698	-25
Greece	35	0	98	98
Israel	7,663	279	283	3
Jordan	212	7	18	11
Lebanon	0	0	0	0
Syria	10,065	173	173	0
Turkey	226	17	1,688	1,671

2.3 HOPES AND CHALLENGES OF THE EAST MEDITERRANEAN GAS DISCOVERIES

The USGS has measured uncovered oil and gas resources in the Levant Basin province, according to the program, which aims at estimating the recoverable oil and gas resources in priority basins around the world. According to that authority, the region could absorb up to 122 trillion cubic feet of natural gas. [10]. In terms of numbers, the area of the Levant Basin is about 83,000 km2 in the eastern Mediterranean region (Fig 2.1). The region is bounded on the east by the transformation zone of the Levant, on the north by the Tartus fault, on the northwest by the Eratosthenes seamount, on the west and southwest by the conical boundaries of the Nile Delta, and on the south by the limits of compressibility in the Sinai. This evaluation was focused on reported geological and commercial data from oil and gas wells, fields, and fields of production. The U.S. SGS approach is to evaluate petroleum systems and geological evaluation units and assess the potential of undiscovered oil and gas resources in each of the three assessment units defined for this analysis-the Levant Plio-Pleistocene reservoirs, sub-salt reservoirs, and marginal reservoirs [11].

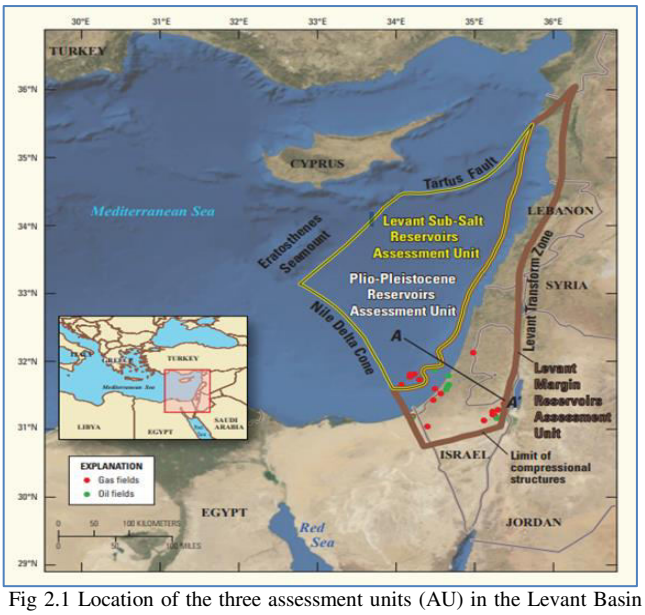

Fig 2.1 Location of the three assessment units (AU) in the Levant Basin Province in the Eastern Mediterranean [11].

The hydrocarbon discoveries in the Eastern Mediterranean have posed the issue of whether or not they would change the game's rules in the region. Globally developed gas reserves amount to about 186,9 trillion cubic meters according to BP figures from 2015 [12]. Relative to the global level, the region has limited global influence, on the other hand, regional discoveries will have a shifting effect for countries like Northern and South Cyprus and Lebanon that rely primarily on imported hydrocarbons for energy production. Israel's experience over the last decade on how to increase the production of natural gas and decrease Israel's reliance on imported hydrocarbons provides hints on the kind of evolving regional, geopolitical, economic, and diplomatic impact that regional resources can have. The production of regional hydrocarbon potential poses several challenges. Besides the need for more exploration and study within the region, there are some challenges that are not clear about maritime frontier demarcation, a well-established framework for exporting to foreign markets, and uncertain regional ties. That's could obstruct the eastern Mediterranean from achieving its full potential [13].

2.4 EASTERN MEDITERRANEAN GAS DISCOVERIES ACCORDING TO THE TIMELINE, THE AMOUNT OF RESERVES, AND THE COMPANIES EXPLORED.

Since 2000, the Eastern Mediterranean region has witnessed the discovery of a significant number of natural gas fields. The area is of great significance as it has significant strategic reserves of 122 trillion cubic feet of gas, according to the 2010 US Geological Survey. In this sense, the most prominent findings in the eastern Mediterranean basin, taking into account the chronology of exploration and development operations, should be noted [14]. In the late 1990s and early 2000s, the American Noble Energy Corporation explored the Mary B gas field, which is situated 25 km off the Gaza Strip and 243 meters below sea level [15]. Reserves are estimated at 1.1 trillion cubic feet of gas. It has been in operation and production since 2004 [16]. The Israeli company Delek Group owns the concession and exploitation of the field by owning (52.9%) of the total share, while the remaining percentage is estimated at (47.1%) by Nobel Energy. In the same year, the British Gas Company, a subsidiary of the British Petroleum Company, announced the discovery of an offshore Gaza field, 36 kilometers off the Gaza Strip, with a total gas reserve estimated at around one trillion cubic feet of gas. The Palestinian authorities have signed a four-year agreement to explore and improve the area with a variety of companies at different rates. British Gas (60 percent) is at the top of the list of firms, followed by Combined Contractors Group (30 percent) and Palestine Investment Fund (10%) [17]. But Israel immediately hampered the agreement by demanding that supplies from the field reach Ashkelon first to fulfill its needs, owing to its determination to monitor flow route from the field into the outside world. Moreover, Israel has set a condition for buying gas at rates below international prices, which the companies have refused [18]. As a result, both the Palestinian authorities and the British Gas Company are unable to perform exploration operations due to Israel's obstinate exploration stance [19]. In the same year, another field called Noa was discovered, located 36 km off the coast of Ashdod at a depth of 750 meters below sea level, with a relatively small reserve of 0.4 trillion cubic feet of gas. The Delek Group (52 percent) and the Nobel Energy Group (47.1 percent) own the entire franchise [20]. The discoveries did not stop at this point, as the discovery continued for ten years until 2009. A number of gas fields were discovered in 2009, the most notable of which was the Tamar field, which was discovered in January 2009 and was the third-largest natural gas field with a total reserve of approximately 9.7 trillion cubic feet. The field is located 90 km off the coast of northern Israel at a depth of 1,650 meters below sea level. Four oil firms have been authorized to conduct exploration work. These companies were Noble Oil, which had 36% of total operations, followed by Delek Group (31.25%), Isramco (28.75%), and Dor Gas (4%). In addition, the Dalit field was discovered 60 km off the western coast of Hadera. It has a comparatively low total reserve in comparison with other fields of the basin, varying from around 0.35 to 0.5 billion cubic feet of natural gas, making it economically less useful. However, four companies are involved in their service despite the small assets in this market. They include Noble Energy (36%), Delek Group (31.25%), Aramco (28.75%), and Dor Gas (4%). In December the same year, Cyprus announced that the Aphrodite field had been found, which lies around 1.700 meters below sea level 180 kilometers off the south-west coast of Cyprus. The gross Aphrodite reserves are measured at 9 trillion cubic feet of natural gas. This field is a supply adequate to meet all of Cyprus' internal gas needs without importing gas from other countries. The Aphrodite exploration only took place through two specialist companies: the U.S. Noble Energy Company, controlling 70% of all operations, and the Delek Group's exploration (30%) [17]. In addition, the discovery of the Dolphin field, which is situated approximately 110 kilometers off the coast of Israel, with gas reserves valued at 0.8 trillion cubic feet of natural gas, took place in November 2011 [21]. Four companies own, explore, and exploit franchise rights in this area. Noble Energy (39.66%), Avanza Oil (22.67%), Delic Group (22.67%), and Ricio Oil (15%). Explorations continued until 2012, one of the most important years in the history of hydrocarbon discoveries in the eastern Mediterranean region.

In a series of findings, the most important one of which is a Tanin field, named "Crocodile" in the Hebrew language, a huge wealth of natural gas has been discovered. This field is the seventh gas field Israel has found, situated 120 kilometers off Israel's coast. Initial forecasts indicated gas reserves of 1.2 trillion cubic feet. It is also regarded as the third-largest field of gas reserves discovered by Israel after the fields of Leviathan and Tamar. Noble Energy (47.06%) and Delek (52.49%) companies implement exploration and exploitation in this area [22]. Two months later, in April, the field of Shimshon was discovered at 1200 kilometers below sea level and 90 kilometers off the western city of Ashkelon with 0.55 trillion cubic feet of reserves. A variety of businesses have been exploring in varying proportions: the Israelis firm ISRAMCO (29%), Modi'in Energy Company (10%), Naphtha Oil (10%), ENOC (11%), and ATB in Israel. By June 2012, Israel announced the discovery, in the eastern Mediterranean region, of the Leviathan field, the second-largest natural gas field to be discovered. It is 17 billion cubic feet in terms of future gas reserves. This area is situated at a depth of 1600 meters under the sea level 135 km from the north coast of Israel, close to the city of Haifa. Three major companies, led by the Delek Group (45.34%), followed by Noble Energy (39.66 %) and Ricchio Öl (15%) have been allocated for exploration and drilling work in these areas. By 2015, the Italian company Eni revealed that it had discovered the largest gas field in the eastern Mediterranean in Egypt. In the south-east Mediterranean region of Al-Shorouk, in the exclusive economic zone of Egypt, Zohr Field is located. The field is 100 square km and depth of (1450 metres), is double the Leviathan gas field [23] and holds an approximate gas reserve of 850 billion cubic meters, equal to (30.3 trillion cubic feet) of natural gas. The field is expected, within four years of its establishment, to meet Egypt's gas needs. A number of foreign news organizations announced on 2 April that Eni sold 10% of its assets on the ground to BP [24]. Russia's Rosneft acquired a 30 % stake in Eni, Italy a couple of months later. The shares of the companies in the sector are Eni (60%), Rosneft (30%), and BP (10%) [25]. respectively.

Two years later, in 2017, Cyprus announced its discovery in the economic waters of Cyprus, 75 kilometers off the south shore, of a large natural gas field. Reportedly 170-230 bcm of gas is present in the reservoir. A European consortium composed of Italian company Eni and French company Total SA will develop the field, situated in block 6 and known as Calypso. In 2019, ExxonMobil discovered a new field in Cyprus near the Glaucus-1 well, which ExxonMobil is currently drilling. According to preliminary estimates, natural gas reserves in the new field could reach 142-227 billion cubic meters (bcm). The Cyprus division of Exxon Mobil Exploration owns 60% of the project, and Qatar Petroleum owns 40% [26].

The Fig 2.2 shows us the most important fields discovered in the Eastern Mediterranean Basin, in addition to the proposed gas pipelines from these wells to processing or export centers, and it shows us the continental shelf of each of the Eastern Mediterranean countries and the complex situation of that region.

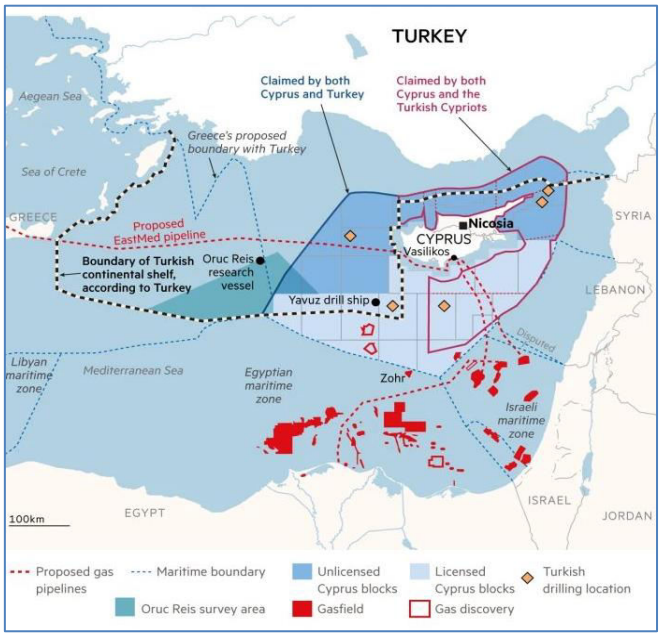

Fig 2.2.The most important fields discovered and proposed gas pipelines in the Eastern Mediterranean Basin [72].

2.5 THE MOST IMPORTANT OFFSHORE NATURAL GAS FELDS IN THE EASTERN MEDITERRANEAN BASIN.

The discovery of natural gas in the eastern Mediterranean region dates back to the beginning of

the 21st century. The first results of the discovery in the eastern Mediterranean off the Israeli coast were the Tamar field, discovered in January 2009, with reserves of 381 billion cubic meters. After that, the Leviathan field was discovered in 2010, which contains nearly two-thirds of the gas located on the Israeli coast with 605 billion cubic meters of gas.

The "Aphrodite" field, with reserves estimated at 129 billion cubic meters, was discovered in September 2011, about 30 kilometers northwest of the Leviathan region, the Italian energy company Eni discovered a field that appeared 190 kilometers north of Port Said in August 2015, with a natural gas wealth of 850 Billion cubic meters.

In 2017, Cyprus announced the discovery of a large natural gas field 75 kilometers off the southern coast. It is estimated that 170-230 billion meters of gas are in the tank.

In 2019, ExxonMobil discovered a new field in Cyprus near the Glaucus-1 well. Natural gas reserves in the new field could reach 142-227 billion cubic meters [27]. See Table 2.2.

Table 2.2.The most significant offshore natural gas fields in the Eastern Mediterranean [27].

Gas field	Country	Year of first gas discovery	Estimated gas reserves
Aphrodite	Cyprus	2011	129 bcm
Calypso	Cyprus	2018	170-230 bcm
Glaucus	Cyprus	2019	142-227 bcm
Zohr	Egypt	2015	850 bcm
Leviathan	Israel	2010	605 bcm
Tamar + Tamar SW	Israel	2009	318 bcm

3. ENERGY TRANSMISSION PIPELINES IN THE EASTERN MEDITERRANEAN.

3.1 THE IMPORTANCE OF ENERGY TRANSMISSION PIPELINES.

The recent discoveries of natural gas in the Mediterranean basin and the convenient location between the major supply and demand centers (the Middle East and Europe) make the Eastern Mediterranean region a distinctive destination for proposals for energy import and export projects. The latest discoveries of natural gas in the Levant Basin have reinvigorated efforts to turn the eastern Mediterranean into an energy development and transport hub. There are plans for the construction of international oil and natural gas pipelines, LNG liquefaction plants in the Eastern Mediterranean, partly due to recent major natural gas discoveries, but also as a reflection of the strategic geographic position of the region. The Eastern Mediterranean location between the major oil producers in the Middle East and the major demand markets in Europe is of strategic significance. In addition, the neighbouring Suez Canal is a significant bottleneck in foreign shipping, in particular oil and petroleum products. Moreover, significant natural gas discoveries abroad are making the region's outlook as an energy hub more promising. At present, there is only one major international pipeline operating in the Eastern Mediterranean region (Arap Gas Pipeline), although there is a range of inactive and planned pipelines that may become essential for energy transmission over the next few years. The potential economic benefits from energy exports are enticing, but there are unresolved concerns that threaten to undermine progress towards that outcome. Moving from discovery to commercial production and from there to export capacity growth requires an ongoing commitment to address many regional issues, including security and economic challenges. In particular, the effect of the current security climate in Egypt, Iraq, Syria, and Turkey will continue to affect the feasibility and attractiveness of foreign pipeline projects in the region [33].

3.2 EXISTING AND POTENTIAL ENERGY PIPELINES IN THE EASTERN MEDITERRANEAN.

In light of the recent gas discoveries in the eastern Mediterranean region, which are likely to lead to meeting the domestic needs of the eastern Mediterranean countries, in addition to the great potential for exports from countries such as Israel and Cyprus. However, these results have sparked controversy over the region's potential export routes.

There are competing plans to develop pipelines and LNG facilities to enable gas export. After much exploration activities in the region, three main options have been built to deal with these gas reserves: pipelines, LNG terminals and compressed natural gas terminals. For pipeline projects, three pipeline scenarios have been proposed during the last period, as shown in Figure 3. The assumed lines are: The pipeline between Israel, Cyprus and Greece (EastMed pipeline); the pipeline between Israel and Turkey, and the pipeline between Israel and the neighbouring Arab countries (Egypt, Palestine, and Jordan) [34]. As for the Israel, Cyprus and Greece pipeline, it is the longest and most complex pipeline in terms of material cost, technical specifications and technology. Although the project is considered one of the projects of common interest to the European Union, it is considered the least likely option for the pipeline due to the high material cost in addition to the legal issues and disputes to extend this pipeline, especially after the signing of the joint maritime agreement between Turkey and Libya, as this agreement cut the way to This pipeline project is without Turkey's approval. The second option is the pipeline between Israel and Turkey. This pipeline is shorter than EastMed pipeline and is considered the most exportable alternative in terms of current regional potential. However, due to the continuing problem with Cyprus and the lingering border disputes, and given that the proposed pipeline could pass through the island or in its territorial waters, this is a major obstacle. Moreover, the deteriorating relations between Turkey and Israel in recent years, especially after the Mavi Marmara crisis in May 2010, constituted another major obstacle to this project. However, over time, the improvement in relations between Israel and Turkey since has increased the opportunities for implementing this project. The third option for the pipeline includes the development of Israeli capabilities and infrastructure and an export mechanism independent of developments and disputes related to the Cyprus issue and exploration activities. It is planned that gas will be exported from Israel to Egypt through the current pipeline system, specifically the Arish Ashkelon pipeline, and new parts and pipelines will be constructed later to meet the Jordanian and Palestinian demand for natural gas. However, due to the nature of the relations between Israel and Egypt, as well as the discovery of the Zohr field with large reserves by ENI on the Egyptian coast, which may lead to meeting Egypt's need for natural gas [34].

In addition to pipelines, various scenarios for using LNG terminals to export regional capacity are considered. In the period from 2011 to 2014, there were various competitive options under consideration for the investment of gas resources. But all of these options require varying levels of cooperation from two or more states, and different degrees of political support. The main problem and the main disagreement revolves around the issue of where to build the LNG plant. There are many proposals to establish natural gas terminals, such as onshore LNG terminals or offshore LNG terminals in Israel or Cyprus. The construction of an onshore or offshore LNG terminal in Israel was considered by many to be risky. While the Vasilikos onshore LNG terminal in Cyprus appears to be the most discussed and widely promoted option and has the greatest opportunity, it appears at the present time an elusive option, due to geopolitical conditions and border disputes as well as low ratings for Aphrodite's reserves [35].

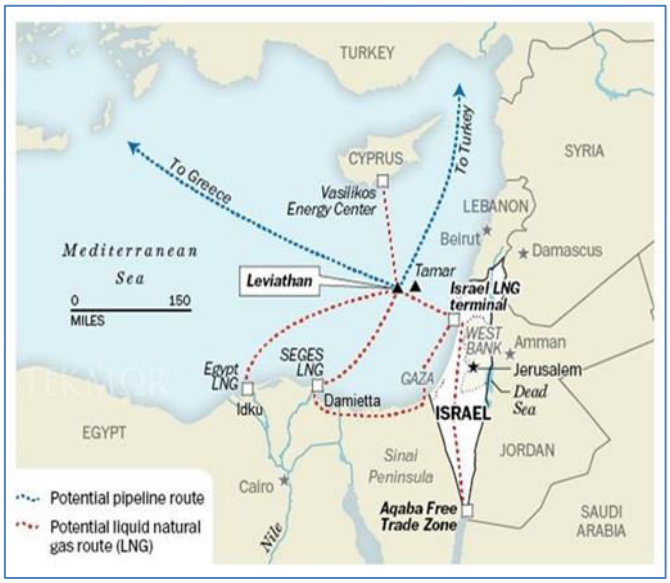

Fig 3. Potential natural gas and liquid natural gas in east Mediterranean [34].

4. CONFLICT OF INTERESTS IN THE EASTERN MEDITERRANEAN

Cyprus was able to sign agreements to demarcate its maritime borders with Egypt (2003), Israel (2010) and Lebanon (2007). However, no such agreement has been reached with Turkey. On the contrary, Turkey reached a maritime boundary agreement with the Turkish Republic of Northern Cyprus in 2011. The Turkish Republic of Northern Cyprus (TRNC) claims 44% of the exclusive economic zone of Cyprus, which Cyprus categorically rejects.

As the search for natural gas reserves intensifies in the eastern Mediterranean, the political tensions are starting to rise. In 2011, shortly after the conclusion of the Turkey and the Turkish Republic of Northern Cyprus agreement regarding the maritime boundaries, Turkey began exploration operations in the disputed maritime areas. Omar Celik, vice president of the ruling Justice and Development Party at the time, announced that a scouting mission with warships had begun and that "we have clearly shown everyone that we will not allow the eastern Mediterranean to become Greek and Cypriot - Israel's goal."

Subsequently, Turkey deployed naval vessels to escort its drilling ships or block navigation for drilling ships of other countries in order to send a clear signal to other regional actors that Turkey did not accept the maritime borders of Cyprus and is prepared to demonstrate its military capability. After sending two warships and a submarine to Cyprus to monitor a drilling vessel in July 2017, the Turkish Ministry of Foreign Affairs stated: "Turkey is determined to protect its rights and interests on its continental shelf and to continue supporting the Turkish Cypriot side.

Six months later, in February 2018, the Turkish Navy stopped a drilling ship that was on its way to conduct drilling operations on Cyprus' behalf, again leading to a diplomatic confrontation between Turkey and Cyprus [75].

Cooperation between Cyprus, Israel and Greece has grown in the eastern Mediterranean in parallel with these tensions. They vigorously explored proposals to build pipeline targeting European markets. Turkey also discussed the possibility of partnering with Israel for a pipeline deal in order to boost its capacity to become a regional gas hub. The strained overall relations between the two countries however prevented the proposal from being implemented.

In 2019, intense events took place. In January, he led to the formation of the Eastern Mediterranean Gas Forum (EastMed Gas Forum EMGF), is a body established in January 2019 and is headquartered in Cairo, Egypt. The forum aims to establish a regional gas market in the eastern Mediterranean region, improve trade relations and secure supply and demand among member states, to Increase the isolation of Turkey in the area. Turkey sent drilling ships into Cypriot waters In May and June, it was seen as a response to Turkey's exclusion from export-oriented cooperation. The European Union condemned the actions of Ankara and implemented punitive measures against Turkey, including suspending ongoing talks and suspending some aid. In response, the Turkish Ministry of Foreign Affairs stated that these measures "will not affect in the slightest the determination of our country to continue hydrocarbon activities in the eastern Mediterranean."

Tensions escalated at the beginning of October 2019, when Turkey confirm that it had already granted exploration rights to another company to send its drilling vessels off South Cyprus. In response, Cyprus, the European Union, and even the United States, warned Turkey not to engage in illegal activities. In order to put pressure on Turkey, in November the European Union adopted a framework for sanctions against Turkey [75].

Turkey's active stance in regional affairs was rooted on November 27, 2019, when it signed a memorandum on the Exclusive Economic Zone (EEZ) with the Libyan Government of National Accord. The Turkish-Libyan agreement established a bilateral system for delineating maritime borders between countries to secure Turkish rights in the Mediterranean and protect them from acts of infringement by third parties. Meanwhile, Turkey's signature of the memorandum with the internationally recognized Libyan government sparked strong criticism from Greece and Egypt, which have petitioned the United Nations.

Regarding the agreement, President Erdoan stated that “Turkey will be allowed to conduct

drilling operations on the continental shelf of Libya legally with the consent of Tripoli ... With this new agreement between Turkey and Libya, we can conduct joint exploration operations in these exclusive economic zones that we enjoy. Problem."

In the light of the last agreement, Ankara has said that other regional countries, such as Cyprus, Egypt, Israel or Greece, cannot continue exploring gas reserves or laying pipelines without its approval, with direct implications for the proposed East Med pipeline project. Following the Tripoli agreement, Erdogan affirmed: "We will use our rights under international law and maritime law to the end in the eastern Mediterranean." [72]. Fig 6.3 shows the Turkish drill ships planned EastMed pipeline and EEZ agreed between Turkey and Libya.

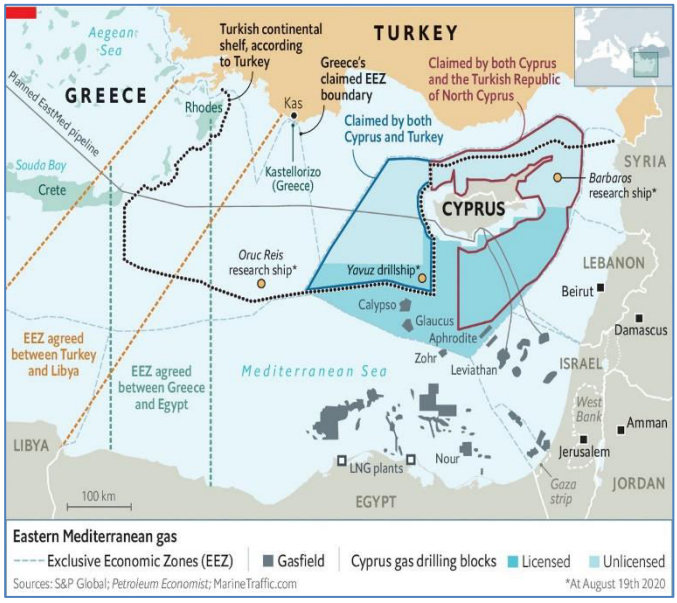

Fig 4. The Turkish research and drillships in the East Mediterranean [72].

In early January 2020, Israel and Greece signed an agreement to develop a 1.900 km East Mediterranean gas pipeline to be completed in 2025 from gas fields in the eastern Mediterranean region. But Turkey opposed EastMed Pipeline and argued that without Ankara's permission the project could not proceed. İn the opinion of Ankara, The project is used only as an instrument to exclude Turkey.

The EastMed pipeline will transport 10 billion cubic meters of natural gas to Europe annually, linking the Israeli Leviathan field with the Cyprus' Aphrodite field for gas exports to the European mainland via Greece and Italy. The European Union has designated the pipeline as a project of common interest and is in the process of completing a detailed feasibility study to assess its future prospects. Ahead of the expected results, the European Commission recently issued a statement saying the pipeline is economically viable and technically feasible. Moreover, the countries involved in promoting this pipeline see this project as the surest route for Eastern Mediterranean gas to reach European shores [39].

In January 2020, tensions intensified following the criticism of Turkish continued exploration activity by the Cypriot Presidency in the disputed waters. Israel started exporting gas to Jordan the same month and to Egypt two weeks later, which is another landmark in regional energy ties. Egypt will soon be able to re-export its liquefaction infrastructure to Israel's gas. While the situation is still complicated, Turkey is continue to explore possible hydrocarbon reserves in the eastern Mediterranean through two sismic vessels for study and two drilling vessels, the third drilling vessel was confirmed to have arrived in Turkey on 15 March 2020 [75].

5. THE NEED TO "ECONOMIC PEACE" IN THE EASTERN MEDITERRANEAN.

The current state of gas exploitation in the eastern Mediterranean remains highly uncertain on the regional and external levels, and turmoil as a result of the war in Syria introduces additional sources of uncertainty that could undermine the projects under consideration by Governments and energy companies. The study of the relationship between markets, political dynamics, and security dynamics, however, provides the basis for understanding gas sector strategies. The geopolitical interests of eastern Mediterranean countries, in particular, have a particular impact on geo-economic decisions on trade flows and trade in gas. The results, however, show that the government is constrained by fiscal, technological, and security considerations in fulfilling its preferred policy options to use natural gas as an instrument for foreign policy objectives. Although the outcomes of various projects are not clear yet the effect of new gas supplies on the regional policy and energy security has already

been achieved. Finally, major external actors were already interested in the emerging gas resources and political and economic competition to monetize them [78].

Although some initial estimates of finding significant energy resources below sea beds could be overestimated in the eastern Mediterranean, energy will continue to have a significant effect on the region's political economy. The total amount of recoverable energy reserves is still too early to be determined. The opportunity to find more energy stocks has rekindled the problem of delimiting EEZs for all the eastern Mediterranean border countries, as well as introducing a possible regional conflict. The position of Turkey was significant not only as a coastal country in the region and a major importer of gas but also as a transport hub for supplying mined hydrocarbons on the global market. Turkish energy supply is also important.

Nevertheless, despite its potential positive repercussion for European energy stability, the Cyprus question and conflicts over the demarcation of the exclusive economic area and the frozen ties of Turkey with Israel have hindered regional cooperation. To resolve the challenges of the war in Cyprus, to demarcate the exclusive economic zones in the eastern Mediterranean region, to the bitter Israeli-Turkish conflict and the effect of the Arab upraises, all parties must cooperate. It is well understood that confidence-building among neighboring countries is difficult in an area affected by persistent strife [79].

Therefore, addressing political issues is important even among countries that already enjoy strong relations. Gas deals are long-term agreements, and while decisions can be pushed through a top-down approach, long-term sustainability hinges on supporting these deals that go beyond the systems that support them. Eastern Mediterranean experience shows that gas reserves are a diplomatic instrument representing the actors' political will. In other words, the capacity of the gas to settle complicated political conflicts in the region needs to be taken realistically [76].

The concept of economic peace, led recently by Obama's administration, has been essential to diplomatic engagement in the eastern Mediterranean. Although the US participation has declined since Trump took office, discussions on the Eastern Mediterranean continued to concentrate on the concept that gas reserves would promote wider regional cooperation. These talks have added relevance to the European Union as they align with the energy interests of the EU. It raises the issue of whether the EU should pursue a diplomatic engagement strategy to improve the stability and protection of energy in the region.

The idea of economic peace suggests that economic integration enhances engagement among allies and creates a space for building trust and cooperation between parties with political grievances. This collaboration may lead to greater stability and may make political breakthroughs easier. The proponents of this idea point to the manner in which trade could continue even in politically challenging circumstances, thus offering possible continuity and a forum for participation, as with Russia's continued flow of gas to Europe following the crisis in Ukraine. Similarly, amid attempts to place sanctions on Qatar, Qatari gas continues to flow to the United Arab Emirates and to Oman. Gas served as the building agent of trust between the Soviet Union and West Germany during the Cold War and authorized dialog two decades before the signing of the Warsaw Treaty.

Gas alone cannot bypass the fundamental political problems which must be addressed in order to achieve real stability. The lack of tension and increased economic development as a result of gas agreements does not entail real stability unless policy problems are also dealt with. The requirements for diplomacy are not substituted by commercial interests but must be supplemented by additional diplomatic investment in order to recognize its possible advantages. Also good gas agreements cannot be isolated from the political climate.

Analysts argue that countries will have an opportunity to circumvent the political impasse to secure these benefits once the material benefits of gas are felt at a regional level. The gas transactions might also contribute to broader cooperation

mechanisms between countries, such as environmental regulations or disaster controls required to support joint energy agreements [76].

The Mediterranean is faced with severe, but not insurmountable challenges. A precondition for fair use of the region's natural resources is to reduce political instability and create trust between coastal states. Once the first political obstacles are reduced and the production of resources at the regional level starts, one might ask if the natural resources will promote Mediterranean peace and stability.

With regard to maritime disputes, the most suitable strategy is to undertake a multilateral diplomatic initiative involving all coastal states, provided that the bilateral approach has not yet been successful. This multilateral diplomatic initiative could have been initially provided by the EMGF as a regional forum. The absence of Turkey from the EMGF, however, considerably restricts its ability to foster extensive regional cooperation. The increasingly strong position of Ankara towards the Mediterranean is motivated by this sense of exclusion and encirclement.

The inclusion of all the main actors - Cyprus, Greece, Israel, and Turkey - and the possibility of including other coastal states in the future - Lebanon, the Palestinian Authority, and Syria - would facilitate the game of positive outcome. Perhaps natural gas could enhance peace in the eastern Mediterranean [72].

4. CONCLUSION

1. The share of natural gas in the world energy market would greatly increase in the predicted future of energy. By 2035, natural gas is expected to be the only fossil fuel whose share of global energy sources will increase. International LNG trading has given the gas markets much-required flexibility to respond to the steep drop in pandemic demand compared with the drop in oil prices to record levels. World proved gas reserves increased by 1.7 Tcm to 198.8 Tcm in 2019. The Middle East region has the largest share of gas reserves, 79.8 trillion cubic meters, about 42.7% of global gas reserves, and the figures released for 2019 indicate that the reserve life of gas in the Middle East is about 108 years.

2. Since 2009, the policies of the Eastern Mediterranean region have changed by a number of significant natural gas discoveries in the Levantine Basin. Israel's discovery of the field of Tamar and the subsequent discovery of the field of Leviathan gave the country a chance to become a regional player in the gas industry. New gas deposits in the Mediterranean have also been discovered by Cyprus and Egypt. At the end of 2011, American companies Noble Energy discovered the area of Aphrodite in Cypriot waters, And in 2015, the Italian company Eni discovered the large Zohr field in Egyptian waters, giving Cyprus the ability to export gas and Egypt more of their domestic gas needs. Turkey has not yet discovered extractable gas reserves, but geological evidence indicates that there is a potential for Turkey to have considerable gas reserves.

3. All major world powers, especially the European Union, have focused on massive discoveries in the region of eastern Mediterranean. The European Union sees this as a real opportunity for ensuring energy security by reducing dependency on Russian gas, and reports show that demand in Europe could exceed 100 billion cubic meters per year by 2030. If the environmental and global warming policies are more strictly applied, demand will continue to rise.

4. Natural gas discoveries are likely to help the entire region' countries, even if Turkey does not yet find reserves in its waters. The infrastructure to reconvert LNG to gas is fast growing and will be able to import more gas in the future. This will help Turkey further diversify its structure of gas imports, which is still a major energy objective for the country.

5. It is clear that governments are well aware of the importance of such resources to support their economies and societies but, in addition to the huge requirements of financing resources due to the high cost of production, they also face major challenges in their development and marketing of gas because of geopolitical disputes, the lack of trust, cooperation and border issues.

6. Each country remains open to all options for developing its own floating or onshore LNG export facilities, linked pipeline networks, and receiving and regasifying facilities to supply the inland market. The options available in the Eastern Mediterranean for the development of offshore gas reserves remain wide open, undermined by significant doubts and challenges, and dependent on the evolving policy, security and economic conditions that are developing rapidly.

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