# THE IMPORTANCE OF SOUTHEAST MEDITERRANEAN NATURAL GAS RESERVES TO EU'S ENERGY SECURITY; A GEOPOLITICAL AND ECONOMIC APPROACH

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**Abstract**

It has been more than a decade since the Southeast Mediterranean region came to the forefront after the discovery of significant gas reserves in offshore fields located within the maritime territories of Egypt, Cyprus and Israel (Levantine Basin). Gradually, the region drew the attention of major oil companies (Total, Statoil, ENI, Exxon Mobil, BP, Rosneft Qatargas) which intensified their drilling operation activities; aiming to share the exploitation of the potential regional gas deposits with the involved countries in the future. The aim of this paper is to investigate (a) the economic impact of these discoveries on the countries concerned, (b) what role can these discoveries play in EU's energy plans, given the stated policy to reduce dependence on Russian supplies and (c) the implementation of a forthcoming energy hub in Southeast Mediterranean region, its viability and competitiveness towards other well-established or emerging gas producing areas. Finally, the paper examines the conflicted interests of European Union, Russia and USA in the energy equation of the region.

**Keywords:** Energy Corridors, Pipeline Networks, EastMed Project, LNG Terminals, Southeast Mediterranean

**JEL classification:** F10, F51, R41, R42, R48

## 1. Introduction

Energy has always been a key component of enhancing European sustainability and welfare. Since 2008, global economy has entered into a new era of economic instability which resulted in protectionist issues where transnational relations are tested. Moreover, the most recent COVID-19 pandemic exacerbates the uncertainty on economic and social level.

Since 2009, the region of the Southeast Mediterranean holds the lion's share of world's interest as the first potential gas reserves in the Levantine Basin came into light and consequently the energy geopolitics pillar emerged. On a pragmatism level, the so far proven reserves could supply the involved countries (Egypt, Israel and Cyprus) with sufficient quantities of gas and provide them the appropriate energy independence in order to meet their domestic needs. On the contrary, the best case scenario orders that more reserves will come into light in the next years and the worldwide impact will be significant.

Despite their sharp fall in the beginning of the pandemic, global energy prices seem to stabilize –WTI and Brent between 40-45 $/barrel. Furthermore, while drilling technologies are being constantly updated in a cost-saving direction, there have been no drilling operations during the COVID-19 period. All the above set the frame under of which, different energy policies and conflicted interests come to the forefront. European Union (EU) seeks to enhance its energy security in terms of supply by implementing a strategy of diversification of counterparts, routes and sources. As a result, EU tries to moderate its energy dependence from Russia, raise the exploitation of domestic sources (the so far proven and future Southeast Mediterranean gas reserves amongst others) and take advantage of the shale gas industry in the United States.

The market dynamics of global energy sector are very fragile nowadays as the status quo is changing; traditional players such as OPEC (mainly Saudi Arabia) seem to step aside via production cuts, while newcomers such as Unites States (via shale oil and gas production), Russia (via gas production in the Arctic), Qatar (via South Pars field) and other energy

superpowers come to the forefront. Additionally, in terms of consumption, the lion's share is being concentrated in Asia (China, India, Japan and S. Korea). At the same time EU promotes its energy transition target by implementing decarbonization policies towards a new "green era". Under this scope, the implementation of a Southeast Mediterranean energy hub might prove a game changer, a project of multilevel benefits but also of certain and important difficulties.

## 2. European Union's energy sector

As it is widely accepted, European Union is mainly an energy consumer and not a producer. In 2019, energy production levels stood at 268 million tons, a 2.2% of global market share. On the contrary, energy consumption levels reached 1643 million tons, a 12% of global market share. As a result, European energy needs outpace production levels by more than five times. As depicted in Table 1, European Union's energy consumption levels have been declined between 2009 and 2019 by 4.1% (BP 2020).

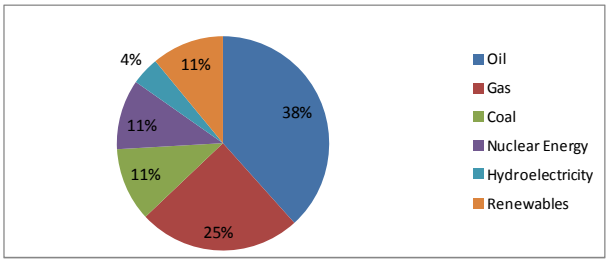
**Table 1. EU's Energy Consumption Levels 2009 vs 2019 (in mil tons of oil equivalent)**

| 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1715 | 1777 | 1719 | 1706 | 1649 | 1632 | 1653 | 1670 | 1692 | 1688 | 1643 |

Source: BP Statistical Review of World Energy – June 2020

European Union adopts a diversified energy consumption policy that includes the use of oil, natural gas, coal, nuclear energy, hydroelectricity and renewable energy in order to support its high domestic demand -mainly attributed to heavy industry, household heating and oil refineries. As depicted in Figure 1, oil and natural gas account for 63% of energy consumption in Europe, while there is a positive trend from the increasing use of renewable energy in power generation -wind and solar parks, as well as of natural gas. It is more than obvious that European Union has already shaped the aforementioned energy transition era towards "green energy projects" as depicted in Table 2. It is important to highlight that oil, coal and nuclear energy consumption levels have been declined in the decade while, renewables consumption levels have reached a decent market share.

**Figure 1: Allocation of EU's energy consumption by fuel (2019)**




Source: BP Statistical Review of World Energy – June 2020

**Table 2. EU's energy consumption levels 2009 vs 2019 by fuel (in mil tons of oil equivalent)**

| Type of fuel | 2009 | 2019 | Decade change (%) | 2009 market share | 2019 market share |
|---|---|---|---|---|---|
| **Oil** | 693 | 630 | -9% | 40% | 38% |
| **Coal** | 268 | 184 | -31% | 16% | 11% |
| **Natural Gas** | 417 | 404 | -3% | 24% | 25% |
| **Nuclear Energy** | 202 | 175 | -14% | 12% | 11% |
| **Hydroelectricity** | 76 | 70 | -8% | 4% | 4% |
| **Renewables** | 59 | 180 | 205% | 3% | 11% |
| **Total** | 1715 | 1643 | -4% | | |

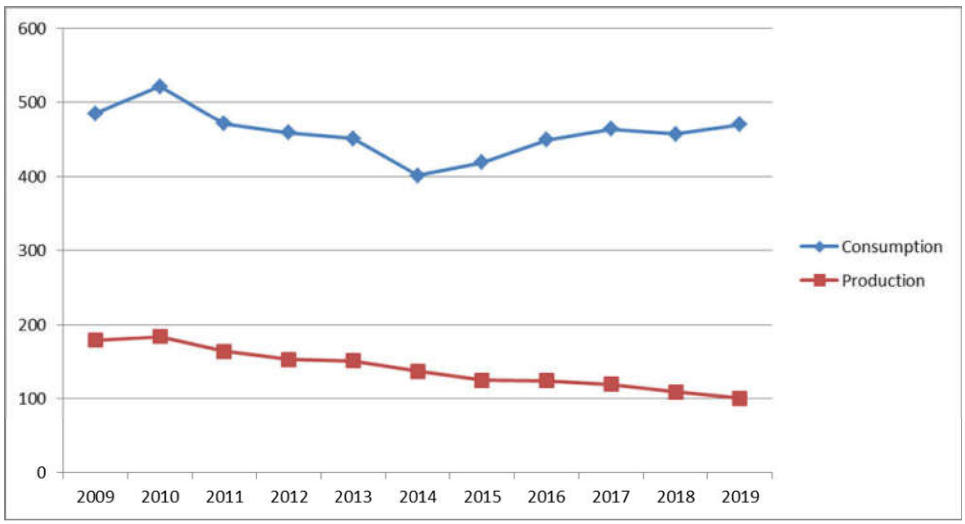
Source: BP Statistical Review of World Energy – June 2020

### 2.1. European Union's gas sector

Gas is an essential component of EU's energy mix, amounting to 25% of primary energy consumption and contributing mainly to electricity generation, heating and fuel for industry

and transportation (Hafner and Tagliapetra 2013). On a worldwide level, EU gas demand holds a share of 12% while, during the last decade it declined from 485 billion cbm in 2009 to 470 billion cbm in 2019. Since 2014 though, gas demand in Europe is on a recovery process. On the contrary, annual gas production during the last decade is on a constant declining mode, from 179 billion cbm in 2009 to 101 billion cbm in 2019 covering only 21.4% of EU's gas needs (Figure 2).

**Figure 2: EU's gas consumption versus production levels 2009-2019 (in billion cbm)**




Source: BP Statistical Review of World Energy – June 2020

It is more than obvious there is a huge supply deficit in EU's gas sector. Taking into account that EU holds only 0.3% of world total proved gas reserves, translated into 700 billion cbm or 23.9 trillion cbf, it comes as no surprise why Europe targets on specific regions in its eastern borders, such as Russia, Azerbaijan and others, in order to cover its energy deficit. The wider region of Eurasia for example holds 32% of world's proven gas reserves, 64.2 trillion cbm.

In 2019, European natural gas trade movements that took place by pipeline stood at 471 billion cbm -80% market share- while the LNG imports via vessels stood at 120 billion cbm (20% market share). Europe imports natural gas via pipelines mainly from Russia and Norway, accounted for 188 billion cbm and 109 billion cbm respectively, while in terms of LNG imports, Qatar supplied 32 billion cbm, Russia 21 billion cbm and United States 18 billion cbm respectively.

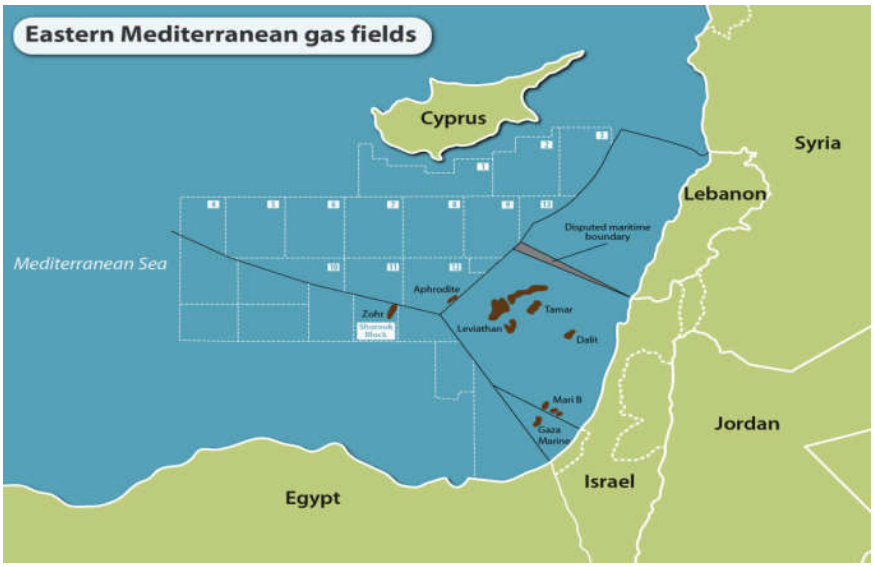
Consequently, EU's gas sector is a highly concentrated market, totally depended on a small number of external suppliers. Furthermore, consecutive and long lasting gas disruptions in many European countries amid Russian-Ukrainian disagreements on pricing and other geopolitical issues had generated a broader European debate over the years on the issue of gas supply security that led European Union in 2008 to take the decision of launching a strategic plan about the diversification of its gas supplies (European Commission 2008).

The anticipated future findings in Southeast Mediterranean could not only support European Union to achieve a steady and reliable domestic gas supply from indigenous sources but also to revive production levels generating cumulative benefits in the region.

## 3. Natural gas reserves in southeast Mediterranean; involved countries' energy needs

As mentioned before, the most important so far proven natural gas reserves in Southeast Mediterranean are mainly concentrated in Levantine basin between Israel, Cyprus and Egypt as depicted in Map 1. The so-called "first round of major gas discoveries" revealed the gas fields of Tamar-Israel, Leviathan-Israel, Aphrodite-Cyprus and Zohr-Egypt between 2009 and 2015. The quite low oil prices between 2015 and 2016 postponed any new drilling activity in the region but since 2017, drilling operations resumed and as a result Calypso-Cyprus Block 6 and Glafkos-Cyprus Block10 gas fields came into light. The exact recoverable quantities of natural gas in the aforementioned offshore fields are depicted in Table 3.

**Map 1: Eastern Mediterranean Gas Reserves**




Source: IEA

**Table 3. Southeast Mediterranean gas reserves and involved countries (in billion cubic meters)**

| Gas Field | Year discovered | Country | Gas Reserves | Operational Status |
|---|---|---|---|---|
| **Tamar** | 2009 | Israel | 280 | Active-2013 |
| **Leviathan** | 2010 | Israel | 600 | Active-2019 |
| **Aphrodite** | 2011 | Cyprus | 140 | *2022-2025 |
| **Karish & Tanin** | 2013 | Israel | 60 | *2H 2021 |
| **Zohr** | 2015 | Egypt | 800 | Active-2017 |
| **Nooros** | 2015 | Egypt | 60 | Active-2015 |
| **Calypso** | 2018 | Cyprus | 198 | None |
| **Glafkos** | 2019 | Cyprus | 180 | None |
| **Total** | | | **2.318** | |

The above natural gas reserves and operational fields are mainly covering the involved countries energy needs. For example, the output from Tamar field yields more than 60% of Israel's electricity while Cyprus aims to do the same since 2022 onwards (Platts 2019). At the moment Egypt emerges as a sole energy hub in Southeast Mediterranean; in 2019 the production capacity of Zohr field reached 28 billion cbm annualy, the largest production capacity in Southeast Mediterranean (ENI 2019), while Egypt also provides important export capacities from Idku LNG terminal.

The so far natural gas reserves in Southeast Mediterranean region are amounting 2.3 trillion cbm and as a result they hold a very limited market share of 1.2% taking into consideration that global proved gas reserves stood at 198.9 trillion cbm in 2019. All the Mediterranean players are dwarfed by Russia (38 trillion cbm), Iran (32 trillion cbm), and Qatar (25 trillion cbm). Moreover, the above gas discoveries do not reveal a sufficient amount of reserves capable of ensuring a steady gas supply to Europe on a permanent and exclusive basis.

Taking into account the current EU's gas consumption levels of 470 billion cbm, the Southeast Mediterranean gas reserves could exclusively cover European gas needs for only 4.9 years. All things considered, the recent findings in Southeast Mediterranean could **partially and for a limited time** contribute to the E.U.'s aim to obtain a steady and reliable domestic gas supply from indigenous sources.

In order to estimate the **future value** of the above natural gas reserves the methodology is as follows:

a) converting cubic meters (cbm) into barrels of oil equivalent (boe)

$$BOE = CBM \; X \; 0.00624096 \qquad (1)$$

b) calculating the decade average (2009-2019) Brent price (BP) based on monthly OPEC reports

$$[AVGBP09 + AVGBP10 + \ldots\ldots + AVGBP19] / 11 = 78.41 \; S/bl \qquad (2)$$

c) then multiplying equations (1) and (2) and we have future value in dollars $

$$\textbf{\textit{Future Value of natural gas reserves = Y x 78.41 \$/bl}} \qquad (3)$$

In order to estimate the **present value** of the above natural gas reserves we make use of the equation

$$PV = FV / (1 + i)^n \qquad (4)$$

PV = Present Value
FV = Future Value
i = annual interest rate
n = number of periods

The natural gas reserves are assumed to be commercially viable over a 20-year period (2025-2045) at a discount rate of 3% annually. The present and future value of the so far Southeast Mediterranean gas reserves as well as their economic impact on the involved countries' regional economies is clearly depicted in Table 4.

**Table 4. Southeast Mediterranean gas reserves present and future values**

| Gas Field | Gas reserves (in bil boe) | Future value (in bil $) | Present value (in bil $) | 2019 GDP (in bil $) | Present value as of GDP (%) |
|---|---|---|---|---|---|
| **Tamar** | 1.75 | 137 | 76 | 395.1 (Israel) | 19.2% |
| **Leviathan** | 3.74 | 293 | 162 | 395.1 (Israel) | 41% |
| **Aphrodite** | 0.87 | 68 | 38 | 24.56 (Cyprus) | 154.7% |
| **Karish & Tanin** | 0.37 | 29 | 16 | 395.1 (Israel) | 4% |
| **Zohr** | 4.99 | 391 | 216 | 303.2 (Egypt) | 71.2% |
| **Nooros** | 0.37 | 29 | 16 | 303.2 (Egypt) | 5.3% |
| **Calypso** | 1.24 | 97 | 54 | 24.56 (Cyprus) | 219,8% |
| **Glafkos** | 1.12 | 88 | 49 | 24.56 (Cyprus | 199.5% |
| **Total** | **14.45** | **1.133** | **627** | **722.86** | **86.7%** |

The present and future value of Southeast Mediterranean gas reserves stand at $627 billion and $1.1 trillion respectively. If proceed in the allocation per country, significant findings emerge; the present value of Israeli total natural gas deposits stand at $254 billion, holding a 64.2% share of country's GDP, while the present value of Egyptian total natural gas deposits stand at $232 billion and a 76.5% share in the country's GDP. As it refers to Cyprus, the present value of its natural gas reserves is a game changer, standing at $141 billion overlapping the country's GDP by almost six times.

All things considered, the so far proven gas reserves in Southeast Mediterranean might not be of significant importance to European Union energy needs –at the moment, but on the contrary, they prove to have an unprecedented economic impact on the involved countries GDP's, so as the cumulative benefits analyzed in the next section.

### 3.1. Southeast Mediterranean countries' energy needs and impact on economies

In the geopolitically fragile Southeast Mediterranean region, Greece, Turkey, Italy, Israel, Egypt, Cyprus, and Libya are involved in shaping the new era in energy geopolitics.

In Cyprus, 94% of primary energy use is imported. Moreover, in 2018 energy consumption stood at 2.15 million tons of which over 2 million tons were oil, as renewable energy sources, biofuels and coal have a minor role in Cyprus' energy profile. Total energy consumption is still below its peak level of 2.75 million tons in 2008 and 18% below the EU

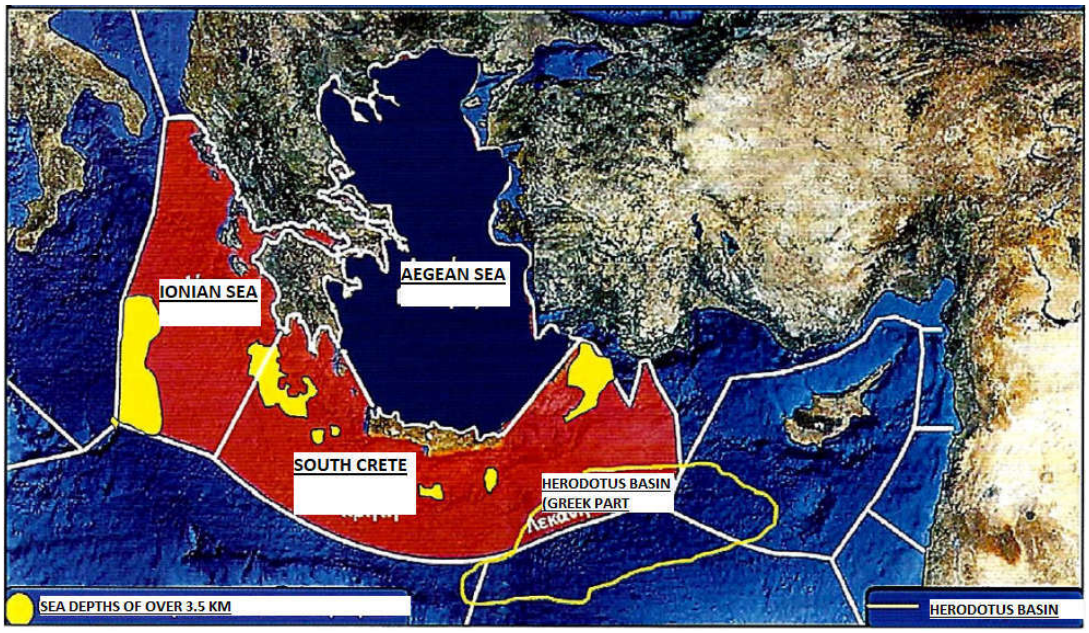
average. The recent gas discoveries give Cyprus the ability to change its orientation from a heavily dependent oil consumer to a sufficient gas producer and consumer (Henderson 2019). Furthermore, a natural gas market is under development and the first deliveries are expected by 2022 via LNG imports through FSRU terminal in Vasilikos. In 2030, the projected natural gas consumption in Cyprus is expected to reach 1 billion cbm, followed by $3 billion of potential savings in power generation, more than 9.000 jobs in natural gas activities. The annual estimated contribution of the above reserves in the Cypriot GDP is approximately 5% (Andriosopoulos 2020).

Egypt is an ambitious player in the region. Its energy consumption levels grew from 75 million tons in 2009 to 93 million tons in 2019, as its' energy sector is mainly dependent on the consumption of natural gas -51 million tons - and oil -36 million tons. As to natural gas consumption, Egypt has raised its from 41 billion cbm in 2009 to 59 billion cbm in 2019. According to BP, Egypt's proved gas reserves are 2.1 trillion cbm - 75.5 trillion cbf, providing energy sufficiency for 35 years, based on its current natural gas needs. Egypt has intensified its gas production levels, achieving a 7.6% growth in the decade -from 60 billion cbm in 2009 to 65 billion cbm in 2019. The surplus of 6 billion cbm in natural gas production is mainly exported to Asia Pacific region -2.7 billion cbm- and to Europe -1.7 billion cbm. In 2030, the projected natural gas consumption in Egypt is expected to reach 90 billion cbm, followed by $32 billion of potential savings in power generation, more than 100.000 jobs in natural gas activities. The annual estimated contribution of natural gas reserves in the Cypriot GDP is approximately 5%.

Greece is a relatively small player in the region. Its' energy consumption levels between 2009 and 2019 declined by 21%, from 34 million tons to 27 million tons. Like Cyprus, Greece's energy sector is mainly dependent on oil consumption -16 million tons- and less on natural gas -4.5 mil tons- and coal -3 million tons. As to natural gas though, consumption have risen by 50% in the last decade, from 3.4 billion cbm in 2009 to 5.1 billion cbm in 2019, mainly attributed to rising LNG imports from Qatar and the United States, as well as to the gradual conversion of the country into an important regional gas hub in Southeast Europe. Current -Revythousa LNG Terminal- and forthcoming infrastructures -TAP Pipeline, EastMed Pipeline and Alexandroupoli FSRU- are going to upgrade Greece's energy profile.

Greece remains one of the most "unexplored" countries of the world in terms of drilling activity, as the country's exploration rate is 4.27, while the global average is 121. The recent natural gas discoveries in Southeast Mediterranean raised again the discussion in Greece and proved to be a turning point offering a new perception of a sleeping energy giant, contrary to common belief. According to latest estimations (Konofagos 2018), there is an average possibility -50%- for the Greek territory to contain huge onshore and offshore hydrocarbon reserves of about 19.5 billion boe or 3.1 trillion cbm, of which more than 80% - 2.5 trillion cbm are located in the area between south Crete and Cyprus, including Herodotus Basin. It comes as no surprise that this area is disputed between Greece and Turkey (Maps 2). The present and future value of Greek hydrocarbon reserves per region are depicting in Table 5.

**Map 2: Greece's EEZ (including Herodotus Basin)**




Source: Konofagos Report

**Table 5. Greek hydrocarbon reserves present and future values**

| Areas | Reserves (in bil boe) | Future value (in bil $) | Present value (in bil $) | 2019 GDP (in bil $) | Present value as of GDP (%) |
|---|---|---|---|---|---|
| **Epirus & Western Greece** | 0.5 | 39 | 22 | 209.85 | 10.5% |
| **Aegean Sea** | 1 | 78 | 43 | | 20.5% |
| **Ionian Sea** | 2 | 157 | 87 | | 41.5% |
| **Offshore South-Southwest Crete** | 12 | 941 | 521 | | 248% |
| **Southeast Crete-Herodotus Basin** | 4 | 314 | 174 | | 82.9% |
| **Total** | **19.5** | **1.529** | **847** | | **403.6%** |

Like Cyprus, the present value of Greek hydrocarbon reserves is a game changer, standing at $847 billion overlapping the country's GDP by almost four times. In 2030, the projected natural gas consumption in Greece is expected to reach 7 billion cbm, followed by $3 billion of potential savings in power generation, more than 16.000 jobs in natural gas activities. The annual estimated contribution of natural gas reserves in the Cypriot GDP is approximately 5%.

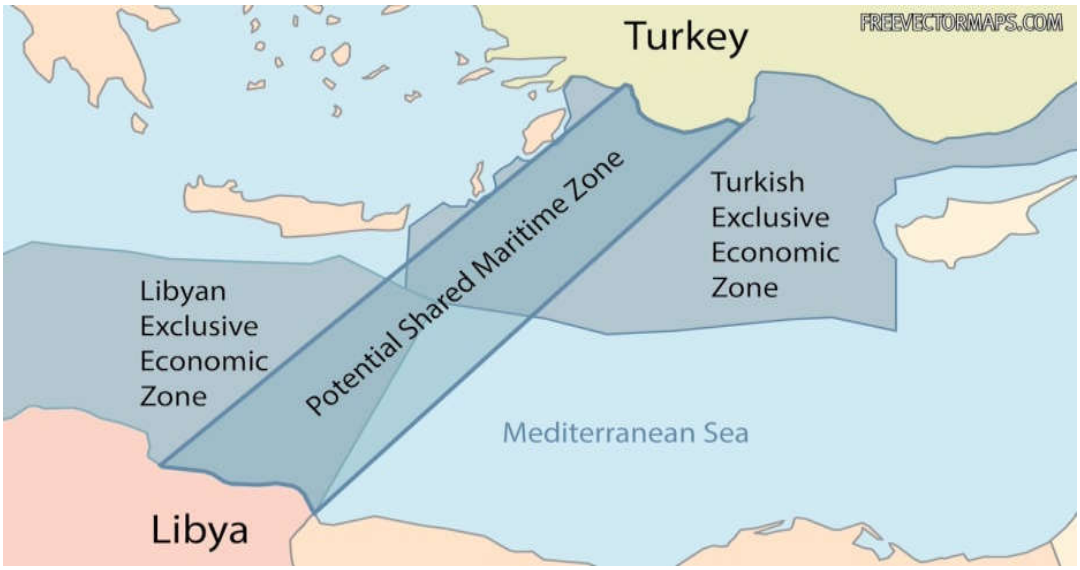
Israel is also a relatively small player in the region that managed to raise its' energy consumption levels from 22 million tons in 2009 to 27 million tons in 2019. Like Greece and Cyprus, Israel's energy sector is heavily dependent on the consumption of oil -12 million tons, natural gas -9 million tons- and coal -5 million tons. As to natural gas consumption levels, Israel shows a strong increase in the last decade from 4 billion cbm in 2009 to 10.8 billion cbm in 2019, achieving seven consecutive years of growth. Moreover, natural gas production in Israel reached 11 billion cbm in 2019. According to BP, Israel's proved gas reserves cover the country's energy needs in natural gas for the next 45 years. In 2030, the projected natural gas consumption in Israel is expected to reach 25 billion cbm, followed by $16 billion of potential savings in power generation, more than 15.000 jobs in natural gas activities.

Italy is the second largest player in Southeast Mediterranean after Turkey. Its' energy consumption levels have declined between 2009 and 2019, from 169 million tons to 152 million tons. The Italian energy sector is mainly dependent on the consumption of natural gas -61 million tons- and oil -59 million tons. According to BP, Italy's proved gas reserves are quite low and constantly declining, reaching 42 billion cbm in 2019 from 100 billion cbm in

2009. As a result, natural gas production in Italy has also declined in the last decade, from 7.6 billion cbm in 2009 to 4.6 billion cbm in 2019. Natural gas consumption levels stood at 71 billion cbm in 2019. The above huge gas deficit might justify the country's indirect –so far- engagement in the geopolitical issues of Southeast Mediterranean. In 2019 Italy imported 13.5 billion cbm of LNG mainly from Qatar -6.4 billion cbm and Algeria -2.9 billion cbm- as well as 54.1 billion cbm via pipelines mainly from Russia -20.7 billion cbm, other European countries -14.2 billion cbm, Algeria -9.7 billion cbm and Libya -5.4 billion cbm.

In Libya, the energy sector is underperforming. Gaddafi's fall and the outbreak of civil war had a huge impact on Libya's natural gas production that declined by 37%, from 15 billion cbm in 2009 to 9.4 billion cbm in 2019. Libya's energy potential though remains strong. According to BP, proved gas reserves are 1.4 trillion cbm something that might justify Turkey's active engagement in the country's political system and the recent memorandum that delineates the maritime jurisdiction between the two countries (Map 3).

**Map 3: Turkey-Libya MoU and Potential Shared Maritime Zone**

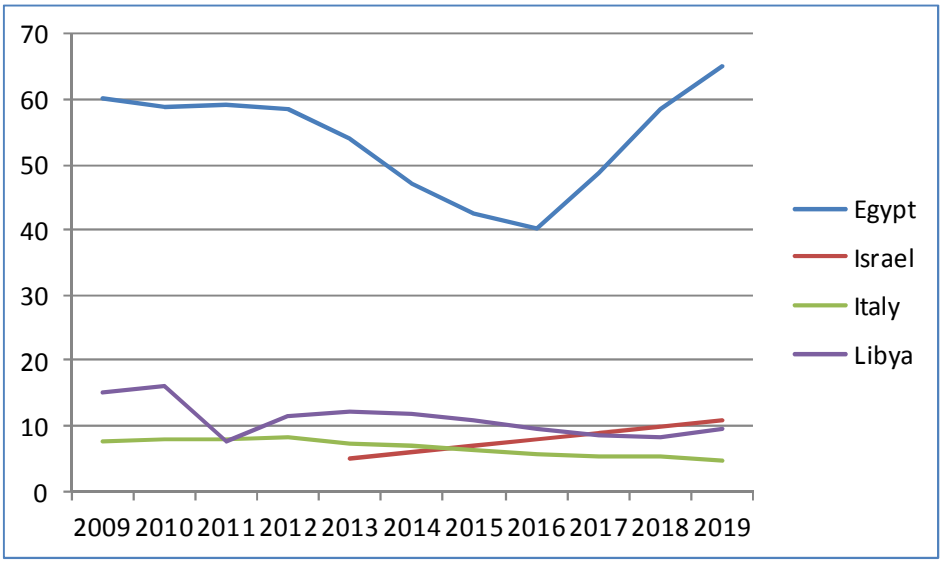



Source: Jerusalem Center for Public Affairs

Finally, Turkey is the largest consumer of the region. Between 2009 and 2019, its' consumption levels have risen from 102 million tons to 155 million tons respectively, a 52% growth in the decade. Turkey's energy sector is heavily dependent on the consumption of oil (48 million tons), natural gas (37 million tons) and coal (41 million tons), depicting an increase in natural gas consumption levels, from 33.7 billion cbm in 2009 to 43.2 billion cbm in 2019. The record high of 51.6 billion cbm gas consumption in 2017 was followed by a downward trend in the last two years, probably attributed to the instability of Turkish economy. In 2019, Turkey imported 12.9 billion cbm of LNG mainly from Algeria with 5.8 billion cbm, Nigeria and Qatar with 2.6 billion cbm each and the United States with 1.2 billion cbm as well as 31.3 billion cbm via pipelines mainly from Russia -14.6 billion cbm, Azerbaijan -9.2 billion cbm- and Iran -7.4 billion cbm.

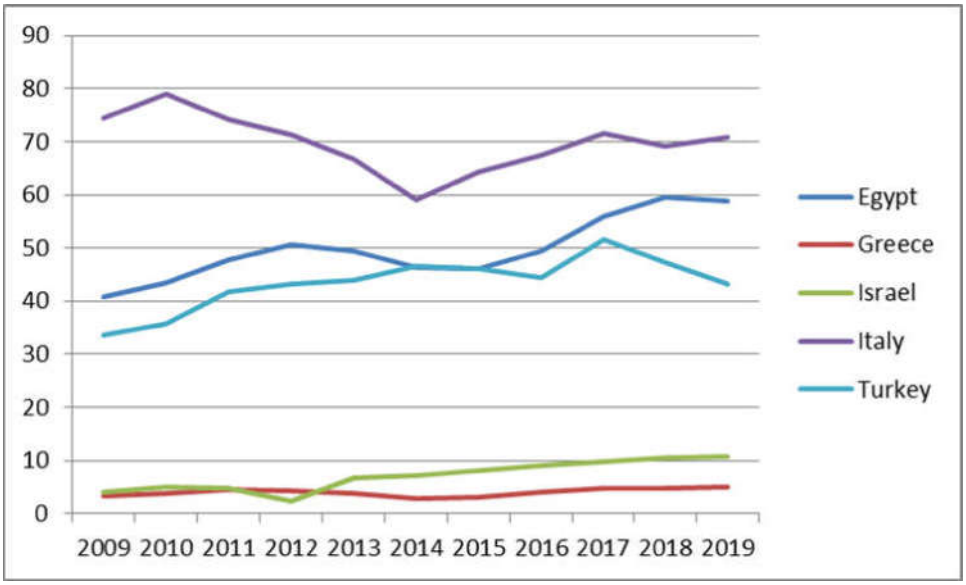
The energy status of all the aforementioned Southeast Mediterranean countries in terms of gas production and consumption is depicted in Figures 3 & 4.

**Figure 3: Southeast Mediterranean countries gas production levels 2009-2019 (in billion cbm)**




Source: BP Statistical Review of World Energy – June 2020

**Figure 4: Southeast Mediterranean countries gas consumption levels 2009-2019 (in billion cbm)**




Source: BP Statistical Review of World Energy – June 2020

## 4. The geopolitical and economic viability of the forthcoming Southeast Mediterranean energy hub

In early 2019, the East Mediterranean Gas Forum was established; a Cairo-based multilateral organization nicknamed "Club Med" that encompasses Cyprus, Egypt, Greece, Italy, Israel, Jordan, and the Palestinian Authority (Emam 2019). The Forum's main target is to promote the region into a major energy hub, to ensure supply and demand and to to offer competitive prices by promoting a "systematic dialogue" between producers and consumers on gas policies (Geropoulos 2019).

The promotion of the Southeast Mediterranean energy hub and the exploitation of the above reserves can be so far implemented by two alternative options (Stratakis & Pelagidis 2018): a) the EastMed Pipeline that could connect Israel, Cyrpus and Greece's future reserves or b) the promotion of an LNG terminals network in the region. The hub's viability is going to be highly depended on the great competition from existing pipeline networks (De Micco 2014) in the wider region as well as on other direct and indirect factors that are going to be analyzed.

The EastMed Pipeline is a planned offshore/onshore natural gas pipeline, directly connecting Southeast Mediterranean energy resources of the Levantine Basin to mainland Greece via Cyprus and Crete (Map 4). The project is designed to transport 10 bcm annually - with a potential to double capacity in the long term, through 1.300 km of offshore pipeline and 600 km of onshore pipeline. It will have exit points in Cyprus, Crete, mainland Greece as well as a connection point with Italy. Construction of the pipeline is expected to cost approximately €6 billion.

**Map 4: The "EastMed Pipeline" and its interconnectors**


Source: IGI Poseidon

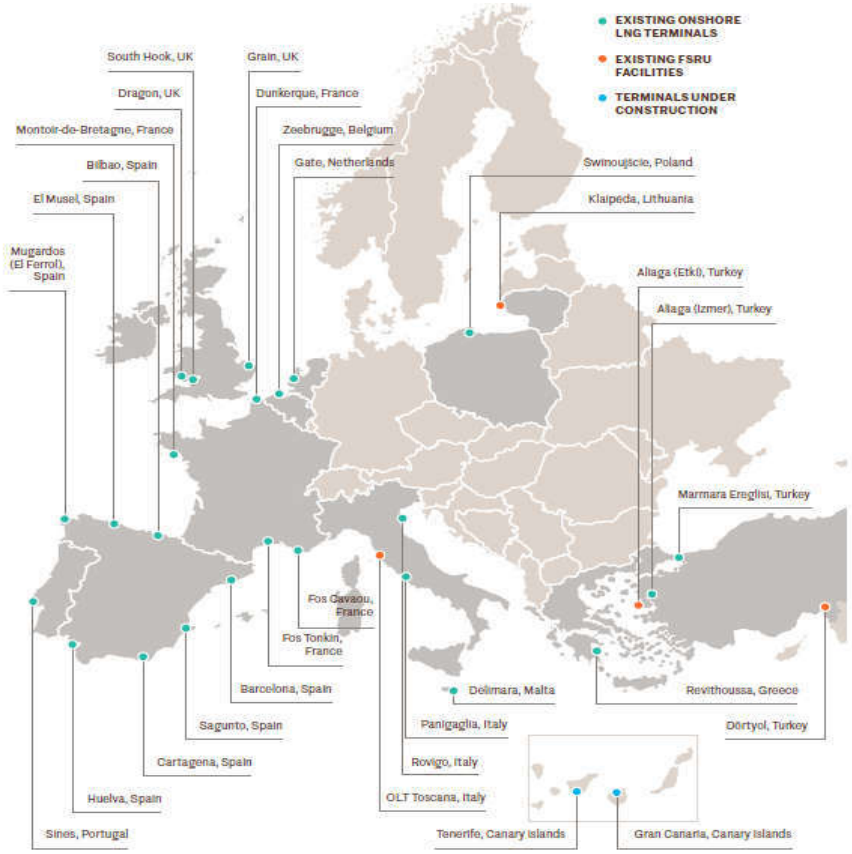
In July 2020 Israel, Cyprus and Greece have accorded to move forward with plans to complete the pipeline by 2025 (Reuters 2020). The countries aim to reach a final investment decision by 2022 (Naftemporiki 2020). The EastMed Pipeline will gain additional importance if the gas deposits in the Herodotus Basin are confirmed. The EastMed Pipeline has been classified as a project of common interest by European Commision, part of the IGI Poseidon Project that also involves Poseidon and IGB pipelines and it is financially supported by European Investment Bank and other institutions.

On the contrary, the trend of FSRU-LNG terminals infrastructure is emerging across Mediterranean Sea (Snyder 2020). If all projects come to fruition, there will be 32 large, mid and small-scale LNG terminals in operation of which, some are being developed to advance European policies of energy independence and security by lessening the dependence on Russian pipeline volumes. As floating terminals are capable of storing and regasifying liquefied natural gas, it would be of great interest if the Southeast Mediterranean ones could operate under a "network" based on the aforementioned state alliances, where terminals would cooperate in exploiting the export volumes, promoting unified pricing policies on the economic benefit of the countries involved.

So far, important investments and sufficient capacities start piling up in Italy -3 terminals of 10 billion cbm annual capacity, Croatia -1 terminal of 2.6 billion cbm annual capacity, Turkey –4 terminals- and Egypt -2 terminals of more than 15 billion cbm annual capacity (Map 5). As it refers to Cyprus, the new FSRU-based LNG import project at Vasilikos Bay will be able to start LNG import operations during H1 2021, designed to accommodate LNG vessels with capacity up to 217.000 cbm.

As far as Greece is concerned, DESFA's Revythousa LNG Terminal with a storage capacity of 225.000 cbm and annual capacity of 7 billion cbm is one of the 28 existing European LNG Terminals and Greece's unique one in accommodating LNG vessels of approximately 175.000 cbm (Geropoulos 2018). Moreover, an FSRU terminal is promoted in Alexandroupolis (Reuters 2015), where Gaslog's converted LNG vessel will be moored to 17 km out of the Alexandoupolis port and will be used as a floating of annual capacity 6.1 billion cbm. The facility is expected to cost between 350 and 380 million euros -$415 million, financed by EU funds. The project has the political support of the United States.

**Map 5: LNG import terminals in Europe**




Source: King & Spalding

Based on the above, the forthcoming Southeast Mediterranean energy hub seems to have the potential to claim a decent market share from its competitors in the decades to come. Its implementation seems to escalate in three phases through a 25-year period: Phase A, where the hub will service involved countries domestic needs, Phase B, where the hub will service EU's energy needs moderating the Russian factor and, Phase C where the hub will be oriented on covering global demand.

Constant discoveries of new gas reserves are a prerequisite in order for the hub to be viable over time. At this point, it needs to be highlighted that Greece could probably be a game changer in the viability of the hub, since as it is already mentioned; there might be 2.5 trillion cbm in offshore gas reserves in the wider region between south Crete and the Greek part of Herodotus Basin, a quantity equal or even higher than the so far discovered reserves in the Levantine basin (ELPE 2020).

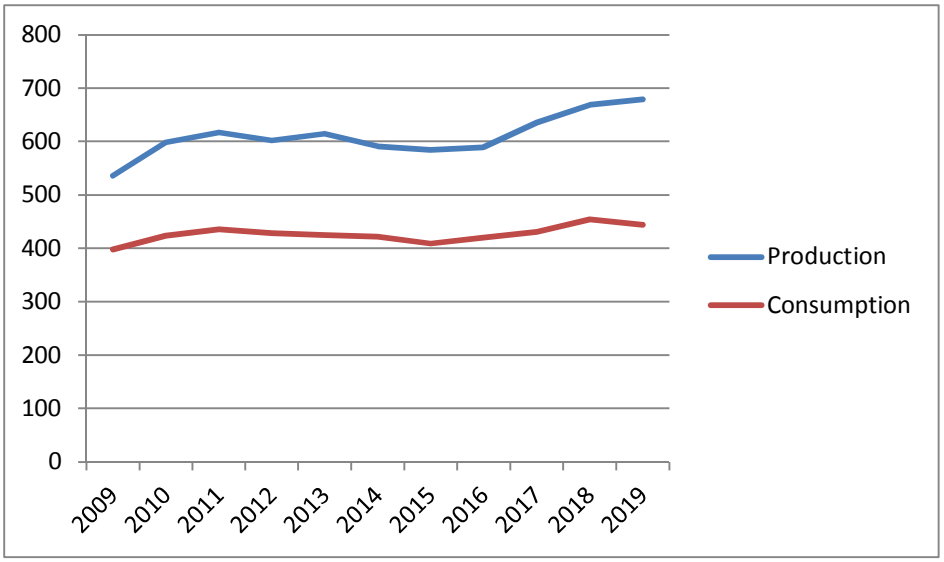
Of course there are other crucial factors needed to be taken into serious consideration before Southeast Mediterranean energy hub proceeds further.

### 4.1. The Russian factor

In the last decade there is an ongoing discussion on whether Southeast Mediterranean reserves could substitute a part of Russian gas flows and if so, up to what extent. Natural gas is an essential component of Russian foreign policy as the country's economic growth is driven by energy exports. Oil and natural gas revenues accounted for 39% of federal budget revenues in 2019 (Russian Ministry of Finance 2019). Russia is also the second largest gas producer worldwide, following United States with 921 billion cbm in 2019.

In 2019, Russia produced 679 billion cbm of natural gas, achieving an impressive 26.6% growth in the decade. On the other hand, and in terms of demand Russia consumed 444 billion cbm, achieving a 11.6% growth in the decade also. That means that Russia has a natural gas surplus of 235 billion cbm available for exports (Figure 5).

**Figure 5: Russian natural gas production vs consumption levels 2009-2019 (in billion cbm)**



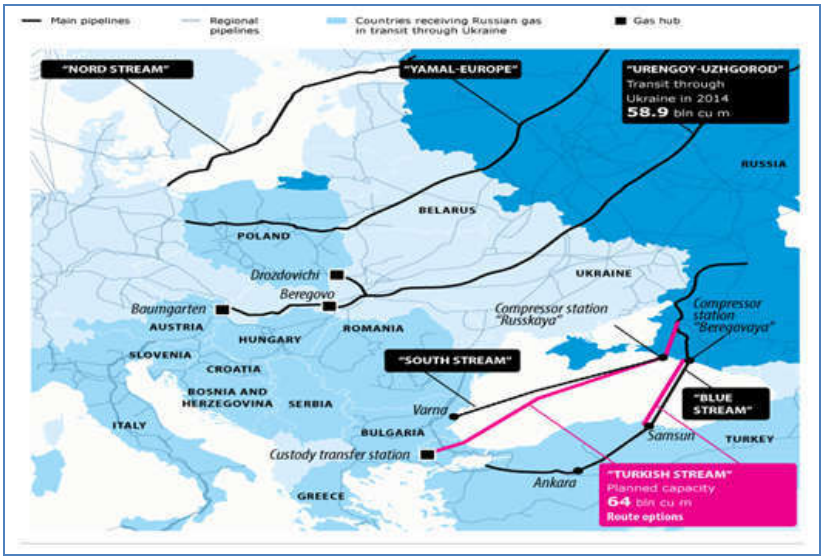

Source: BP Statistical Review of World Energy – June 2020

Russia's geopolitical concept is to encircle Europe with natural gas pipeline networks (Stratakis & Pelagidis 2019). The existing Russian gas pipeline network to Europe consists of (Map 6):

- Gazprom's "Nord Stream Pipeline" with a combined annual capacity of 55 billion cbm connecting Russia and Germany across the Baltic Sea,
- Gazprom's "Yamal-Europe Pipeline" with an annual capacity of 33 billion cbm connecting Russia and Germany through Belarus and Poland,
- Gazprom's "Blue Stream Pipeline" with an annual capacity of 16 billion cbm connecting Russia and Turkey, servicing Turkey's ambitions to be converted into the main energy hub in South-East Europe and an alternative import gate of Russian gas into Europe
- Gazprom's "TurkStream Pipeline" with an annual capacity of 31.5 billion cbm and a €11 billion construction cost, operative since January 2020. The project supplies equally Turkey and southeast/central Europe -17.5 billion cbm each- through Balkans and,
- d) the "Urengoy-Uzhgorod Pipeline" with an annual capacity of 32 billion cbm connecting Russian Siberia through Ukraine with Austria

Russia intends to gradually replace gas supplies to Europe through Ukraine and the "Urengoy-Uzhgorod Project" by "Nord Stream 2 Pipeline", a project in which five European energy companies are engaged with Gazprom, in order to construct an additional 1200 km pipeline that would transfer annually 55 bcm of Russian gas through the Baltic Sea to Germany. The total cost of the pipeline is estimated at $10.3 billion, scheduled to be completed by the end of 2020. The energy dependence of Germany on Russia has drawn heavy criticism from the United States, an emerging and ambitious supplier of LNG to Europe. While Russia seeks diversified energy routes that would seal its dominance over European gas markets, the USA is objected on both economic and political grounds (Geropoulos 2019).

**Map 6: Russian Pipeline Networks in Eastern Europe**




**Source: Gazprom**

In 2019, Russia totally exported 257 billion cbm of natural gas, a decade record high of which, 208.5 billion cbm were headed to Europe -188 billion cbm via pipelines and 20.5 billion cbm via LNG exports. On the contrary, European natural gas imports in 2019 stood at 591 billion cbm; in other words, Russian annual gas flows to Europe hold a 35% market share in European natural gas imports. At the moment, it seems quite difficult for the Southeast Mediterranean energy hub to substitute a huge part of Russian share.

### 4.2. The Turkish factor

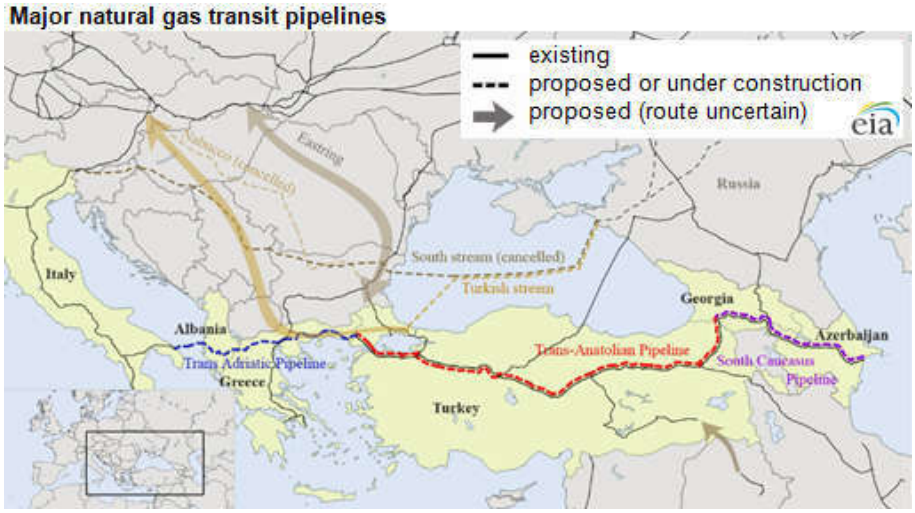
Turkey aims to become the major energy hub in the region by transiting natural gas flows from Caucasus and Central Asia, Middle East and Southeast Mediterranean to the rest of Europe. At the same time, it seeks to ensure domestic energy security by cementing its geostrategic importance. In this strategy, Turkey found a willing partner in Russia and the latter has found an important pillar to promote its energy interests in Southeast Europe.

Furthermore, Turkey remains the only energy gateway to Europe for emerging gas producers, such as Azerbaijan. The "Trans Anatolian Gas Pipeline-TANAP" carries gas from Azerbaijan's Shah-Deniz gas field of 1.2 trillion cbm capacity, to Italy's southeastern shore via Greece's "Trans Adriatic Pipeline -TAP", as depicted in Map 7. With a capacity of 16 billion cbm, 6 billion cbm cover Turkish domestic needs and the rest will be delivered to European countries once TAP Pipeline is completed (Barden 2015). TANAP had a construction cost of $8.5 billion and is in operation since June 2018. By 2030, an increase of pipelines annual capacity to 60 billion cbm is planned.

TANAP is a part of a $45 billion project called "Southern Gas Corridor", an initiative of the European Commission for a natural gas supply route from the Caspian and Middle Eastern regions to Europe, aiming to reduce Europe's dependency on Russian gas and add diverse sources of energy supply by providing the necessary transportation capacity to deliver 60–120 billion cbm annually.

For the time being, there is a maritime area in dispute between Turkey and the Republic of Cyprus. The dispute extends to Greece as it refers to Kastelorizo, the area southeast of Crete and Herodotus basin (Map 8). Turkey claims an excess continental shelf of 148.000 km2 and as a result, its intensified naval presence in the region has postponed any new research and exploitation activity.

**Map 7: TANAP and TAP Projects**




Source: EIA

**Map 8: Conflicting EEZ between Greece/Cyprus and Turkey**

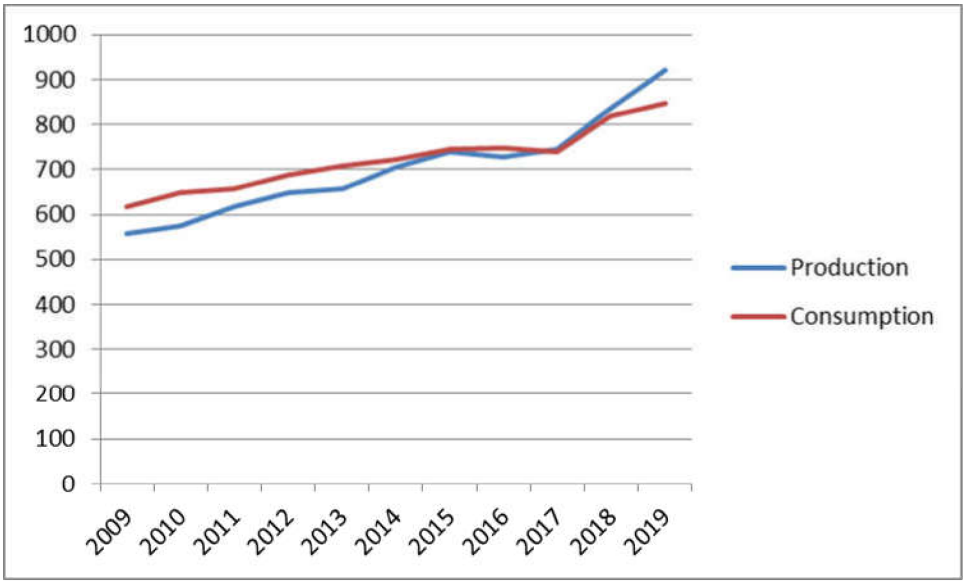

Source: Hurriyet

### 4.3. The United States factor

Since 2012 and the shale gas revolution in their domestic industry, United States have stepped forward and in less than a decade they have been declared as world's largest natural gas producer. At the same time, they hold a 6.5% of global share with 13 trillion cbm natural gas reserves. Between 2009 and 2014 United States had to manage their natural gas supply deficit while since 2017 they ramped up their production levels resulting in an important surplus that gives them the opportunity to be introduced as a natural gas producer and exporter (Figure 6).

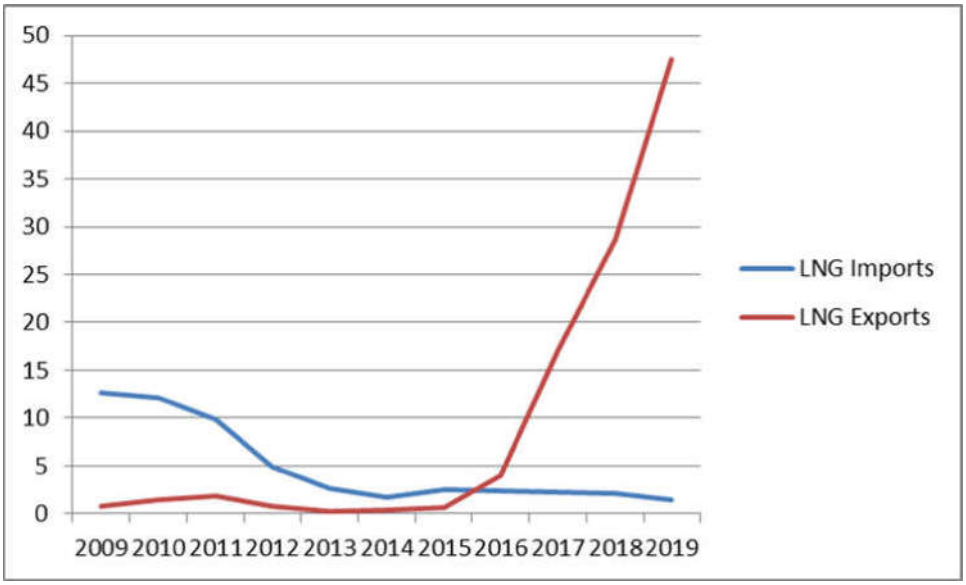
Indeed, between 2009 and 2019 LNG imports to the United States have been declined from 12.6 billion cbm to 1.5 billion cbm respectively, while LNG exports have been skyrocketed from 0.8 billion cbm to 47.5 billion cbm respectively (Figure 7). It is estimated that by 2025 American LNG exports are going to reach 120 billion cbm, overtaking countries such as Australia, Qatar and Russia. Indicatively, during 2019 Europe was the primary destination of American LNG with 38.5% market share and 18.3 billion cbm while Asia Pacific region followed with 17.8 billion cbm. As it refers to Europe, in 2019 the United States were the third largest LNG supplier following Qatar with 32.3 billion cbm and Russia with 20.5 billion cbm (European Commission 2019) while, in the first five months of 2020, the United States became the largest source of LNG supply to Europe, overtaking Qatar and Russia achieving a 25% market share.

**Figure 6: United States natural gas production vs consumption levels 2009-2019 (in billion cbm)**




Source: BP Statistical Review of World Energy – June 2020

**Figure 7: United States LNG imports vs LNG export 2009-2019 (in billion cbm)**




Source: BP Statistical Review of World Energy – June 2020

A competitively priced American LNG and the appropriate market conditions could play an increasing and strategic role in EU gas supply. Increased imports contribute to the EU's goal of diversification of energy supply as, the EU gas market is the second biggest single gas market in the world after the United States. European gas imports are projected to increase in the years to come as its domestic production is decreasing, while demand is projected to remain at a comparable level as natural gas has been identified as an important transition fuel in the EU's efforts to decarbonise its economy.

All things considered, it is important to highlight the new geopolitical aspects of the American presence and the promotion of its interests in the region of Southeast Mediterranean.

### 4.4. Opportunities and barriers in the implementation of a Southeast Mediterranean energy hub

The emerge of an energy hub in Southeast Mediterranean region indisputably enhances European security of gas supply (Tzogopoulos 2017). Greece and Cyprus are devoted to the principles of European Union, consisting important pillars that provide sustainability in a very fragile region -political unrest in Turkey and Libya, Syria Civil War etc. Moreover,

alternative plans about the construction of a new undersea pipeline in order to conduct exports of the region's reserves via Egyptian LNG terminals -Idku and Damietta- seem to be quite a risky business, as Egypt is indebted to energy companies (Baconi 2017). The successful operation of a Southeast Mediterranean energy hub would mean a lot for Greece and Cyprus, two countries that had been under strict European financial supervision in the last decade and are in a high need to attract massive investment programs.

As analyzed in section 3.1, the development of domestic gas markets in the involved countries would strengthen local economies, support private investments and create skilled workforce. On a second phase, the combined profits from direct sales of gas to regional markets could generate several billion of euros on a long term basis (Tsakiris 2016). For the time being, Turkey's maximalist ambitions and aggressive presence in the region intimidate international oil companies' plans resulting in postponing massive investment projects (Ellis 2017).

As it refers to the implementation of the Southeast Mediterranean energy hub and its final form several scenarios have come into light. According to the best case scenario the promotion of EastMed Pipeline seems to be a technically feasible and economically viable option as, important industry players –Edison and DEPA- have confirmed their participation in the project. In general, all energy companies engaged in the exploitation of Southeast Mediterranean gas fields are pioneers in global oil and gas industry, fully expertised in similar project around the globe and with all the appropriate equipment. As a result, in most cases they handle their operational expenses efficiently.

On the contrary and according to a modest scenario, constructing EastMed Pipeline requires a high capital investment of about $ 6 billion that could create obstacles in terms of return on investment. Moreover, certain technical challenges such as the unprecedented depth of 3 km in southern Crete that the pipeline must reach raise infrastructure costs and jeopardize the final gas prices offered while they have to rival the cheaper Russian or Qatari gas. In general, pipeline projects require large initial capital outlays and they must be able to secure long-term commitments from buyers, guaranteeing 10-20 years of cash flow.

It should be also highlighted that as global energy market remains fragile and global energy prices outlook uncertain due to COVID-19 pandemic, there will be an unavoidable slowdown in Southeast Mediterranean Energy Hub's emerge (Stratakis & Pelagidis 2020). According to latest estimations, during 2020 the industry will experience the largest recorded demand shock in the history of global natural gas markets, as gas consumption is expected to fall by 150 billion cbm, twice the size of the drop following the 2008 crisis (IEA 2020). The major consumption decline is expected in mature markets across Europe, North America and Asia while, natural gas demand will progressively recover between 2021-2025. Consequently, the Covid-19 crisis will have long-lasting impacts on natural gas markets resulting in 75 bcm of lost annual demand by 2025. As expected, energy companies' appetite in investments is clearly negatively affected (Exxon Mobil 2020).

It goes without saying that the existing and proposed pipeline networks analyzed in sections 4.1 and 4.2 will definitely cause a "pipeline bottleneck" in the region and harsh competition on a first place. Many analysts are quite pessimistic regarding the completion of the proposed pipelines in total. Inevitably some of them will remain plans given the so far proven reserves is Southeast Mediterranean unless, new immense reserves coming into light and give new gravity to the aforementioned pipeline networks. In any case, pipeline networks remain highly depended on geopolitical issues, face capacity restrictions and discontinuities in finance and long term implementation schedules that in most of cases extend to over a decade. All the above might jeopardize the perspective of a Mediterranean Energy Hub Project based on pipelines.

Intense geopolitical competition might requires the adoption of a more flexible, safe and cheaper option - millions instead of billions invested- of exploiting Southeast Mediterranean reserves such as, a floating LNG terminals network between the involved countries. Converted LNG vessels of capacity between 150.000 to 250.000 cbm are being used as floating storage and regasification units. That practice leads to production security, independence from geopolitical factors, immediate adjustment to demand spikes, transport flexibility and guaranteed return as commercial LNG vessels can be long-term chartered to deliver shipments all across the globe.

Furthermore, Greek and Cypriot maritime cluster could play a vital role by providing a modern and cutting edge technology LNG fleet -16.3% market share in terms of global fleet capacity (UGS 2020), as well as integrated and wide esteemed shipping management practices. Additional factors such as close proximity to key maritime routes –Suez Canal – and emerging markets –Asia Pacific and the existence of the entire appropriate infrastructure - port terminals, refineries, shipyards and human capital- ensure the viability of this option.

Finally, time is not an ally since according to the latest estimations the era of Renewable Energy Sources is approaching; between 2030 and 2035 renewable energy sources will cover a decent market share of more than 20% of global energy consumption (DNV GL 2020). As a result, it is of high importance for Southeast Mediterranean gas reserves to be exploited the soonest possible, as the fossil-fuel share of the energy mix will decline from 81% to 54% by 2050.

## 5. Conclusions

The main challenge in the exploitation of Southeast Mediterranean gas reserves is the high drilling cost as well as the political and logistical complexity of reaching markets in the second phase. The building of pipelines has developed into a fully-fledged geopolitical and economic fight and, thus, is of great importance in the understanding of the situation and in developing win-win solutions for all regional parties. As it refers to the involved countries so far, Israel fuels most of the country's domestic needs by its own gas. Along with Cyprus, they have an ever greater need to find export options given their very small domestic market. At the moment, a pipeline to an Egyptian LNG plant with spare capacity seems to be the most reasonable option. On the other hand, Egypt became self-sufficient in natural gas in late 2018 and is seeking to become a regional energy trading hub.

Judging by its recent movements and the escalated tension in Southeast Mediterranean, Turkey seems unwilling to be restricted as a transit energy hub only, intending to move a step forward by continuously contesting the boundaries of the exclusive economic zones of Greece and Cyprus, demanding the lion's share of the revenues generated from the exploitation of proven and future gas reserves in the region. Turkey's strategic goal is to maximize its geopolitical position, extending its claims from the Aegean Sea and the Southeast Mediterranean, to the areas of Syria and Iraq.

On the contrary, Greece promotes a diplomatic stance via the proclamation of its Exclusive Economic Zone with neighboring countries such as Italy, Albania, Egypt and Cyprus excluding Turkey. For the moment, Greece remains an x-factor in the region as if the anticipated Herodotus basin gas reserves are proven to be recoverable, then the whole area between 28th and 32nd meridian will come at the forefront and will definitely shape the final form of the anticipated Southeast Mediterranean energy hub which would lead to competitive advantages and the establishment of a new geopolitical status-quo in the region.

All things considered, the aim of this paper was to highlight the importance of Southeast Mediterranean gas reserves to Europe's energy needs, taking into account the geopolitical implications between involved countries combined with the interests of the United States and Russia in the region. Simply put, Southeast Mediterranean has a limited strategic role to play in terms of European energy independence as its importance lies primarily on the economic impact that an increase in energy self-sufficiency will have in the countries of the region.

Finally, the uncertainty about the duration and impacts of COVID-19 on global economy, as well as to energy prices and other industrial sectors, could definitely slow down any vast investment in the region.

## 6. References

Andriosopoulos, Kostas. 2020. "The potential contribution of natural gas to East Mediterranean economy", HAEE 2020 Conference

Baconi, Tareq. 2017. "Pipelines and Pipedreams; How the EU can Support a Regional Gas Hub in the Eastern Mediterranean", European Council on Foreign Relations, https://www.ecfr.eu/publications/summary/pipelines_and_pipedreams_how_the_eu_can_support_a_regional_gas_hub_in_7276 (accessed October 22, 2020)

Barden, Justine. 2015. "Natural gas pipelines under construction will move gas from Azerbaijan to southern Europe", https://www.eia.gov/todayinenergy/detail.php?id=23332 (accessed October 21, 2020)
BP Statistical Review of World Energy (2020), https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf (accessed October 20, 2020)
De Micco, Pasqualle. 2014. "The Prospect of Eastern Mediterranean Gas Production: An Alternative Energy Supplier for the EU?" Policy Department, European Parliament", https://www.europarl.europa.eu/RegData/etudes/briefing_note/join/2014/522339/EXPO-AFET_SP(2014)522339_EN.pdf (accessed October 21, 2020)
DNV GL, 2020. "Energy Transition Outlook 2020 Executive Summary; A global and regional forecast to 2050"
Ellis, Athanasios. 2017. "Erdogan threatens gas companies", http://www.kathimerini.gr/901241/article/epikairothta/politikh/o-erntogan-fovizei-tis-etaireies-aerioy (accessed October 22, 2020)
ELPE. 2020. "Possible large hydrocarbon deposit in Crete", https://www.kathimerini.com.cy/gr/ellada/pithano-megalo-koitasma-ydrogonanthrakon-stin-kriti (accessed October 21, 2020)
Emam. Amr. 2019. "Eastern Mediterranean Gas Forum a powerful new global player", https://thearabweekly.com/eastern-mediterranean-gas-forum-powerful-new-global-player (accessed October 21, 2020)
ENI 2019. https://www.eni.com/en-IT/operations/egypt-zohr.html (accessed October 20, 2020)
European Commission, 2019. "U.S. liquefied natural gas exports up by 272% as EU and U.S. host High-Level Business-to-Business Energy Forum", https://ec.europa.eu/commission/presscorner/detail/en/IP_19_2313 (accessed October 22, 2020)
European Commission. 2008. Second Strategic Energy Review-an EU Energy Security and Solidarity Action Plan, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0781:FIN:EN:PDF (accessed October 20, 2020)
Exxon Mobil, 2020. "Plans of withdrawing from North Sea", https://www.kathimerini.gr/economy/international/1038350/i-exxonmobil-schediazei-apochorisi-apo-ti-voreia-thalassa/ (accessed October 22, 2020)
Geropoulos, Kostis. 2018. "Greece launches expanded LNG terminal to deliver gas to the Balkans" https://www.neweurope.eu/article/greece-launches-expanded-lng-terminal-to-deliver-gas-to-the-balkans/ (accessed October 21, 2020)
Geropoulos, Kostis. 2019. "East Med countries agree to create regional gas market", https://www.neweurope.eu/article/east-med-countries-agree-to-create-regional-gas-market/ (accessed October 21, 2020)
Geropoulos, Kostis. 2019. "US and Germany spar over Nord Stream-2", https://www.neweurope.eu/article/us-and-germany-spar-over-nord-stream-2/ (accessed October 21, 2020)
Hafner, Manfred. and Simone Tagliapietra. 2013. "The Globalization of Natural Gas Markets: New Challenges and Opportunities for Europe". Claeys & Casteels Publishing
Henderson, Simon. 2019 "Cyprus Gas Discovery Could Be an East Mediterranean Game-Changer" https://www.washingtoninstitute.org/policy-analysis/view/cyprus-gas-discovery-could-be-an-east-mediterranean-game-changer (accessed October 21, 2020)
IEA, 2020. "Gas 2020; analyzing the impact of the Covid-19 pandemic on global natural gas markets", https://www.iea.org/reports/gas-2020 (accessed October 22, 2020)
Kings & Spalding. 2018. "An overview of LNG terminals in Europe", https://www.kslaw.com/blog-posts/lng-in-europe-2018-an-overview-of-lng-import-terminals-in-europe-2 (accessed October 21, 2020)
Konofagos, Elias. 2018. "Prospects for exploration and exploitation of Greece's domestic hydrocarbons between 2030-2050", Athens Academy Energy Committee
Naftemporiki. 2020. "EastMed Pipeline's final investment decision", https://www.naftemporiki.gr/finance/story/1607617/depa-se-2-3-xronia-i-teliki-ependutiki-apofasi-gia-ton-eastmed (accessed October 21, 2020)
Platts 2019 "Cyprus gas field project still on despite Israeli claim: minister". https://www.hellenicshippingnews.com/cyprus-gas-field-project-still-on-despite-israeli-claim-minister/ (accessed October 20, 2020)
Reuters. 2015. "Cheniere Energy eyes stake in Greek LNG project", https://www.reuters.com/article/cheniere-energy-greece-idUSL8N1452RH20151216 (accessed October 21, 2020)

Reuters. 2020. “Israel approves pipeline deal to sell gas to Europe”, https://www.reuters.com/article/us-israel-europe-natgas/israel-approves-pipeline-deal-to-sell-gas-to-europe-idUSKCN24K0FN (accessed October 21, 2020)

Russian Ministry of Fiannce, 2020. “Federal Budget of the Russian Federation”, https://minfin.gov.ru/en/statistics/fedbud/ (accessed October 22, 2020)

Snyder, John. 2020. “Floating LNG ratchets up in the Mediterranean”, https://www.rivieramm.com/news-content-hub/news-content-hub/floating-lng-ratchets-up-in-the-mediterranean-58961 (accessed October 21, 2020)

Stratakis, Antonios, and Pelagidis Theodore. 2018. “The South-East Energy Corridor connecting Greece and Cyprus; How feasible, how viable”, Eastern Mediterranean Geopolitical Review Volume 3, pp. 16-33, Cyprus Center for European and International Affairs, University of Nicosia

Stratakis, Antonios, and Pelagidis, Theodore. 2019. “The Viability of a Mediterranean Energy Hub and the Interests of European Union and Russia: Common or Conflicted?”, Journal of Law and Administration No 4 (53), pp. 69-91, Moscow State Institute of International Relations – MGIMO University

Stratakis, Antonios, and Pelagidis, Theodore. 2020. “COVID-19 and Energy Shifts in South East Mediterranean; a Possible Correlation?”, Special Issue in Depth/Innovation “COVID-19 and Political Change; Towards a paradigm shift?” Volume 17-Issue 4, pp. 8-10, Cyprus Center for European and International Affairs, University of Nicosia

Tsakiris, Theodore. 2016. “The Gifts of Aphrodite: The Need for Competitive Pragmatism in Cypriot Gas Strategy?”, Energy Cooperation and Security in the Eastern Mediterranean: A Seismic Shift towards Peace or Conflict?, (Tel Aviv University Press: 2016), pp.22-37

Tzogopoulos, George. 2017. “The EastMed Pipeline could be a giant step towards enhancing regional security”, BESA Center Perspectives Papers, https://besacenter.org/perspectives-papers/eastmed-pipeline-security/ (accessed October 22, 2020)

Union of Greek Shipowners, 2020. “Annual Report 2019-2020”, https://www.ugs.gr/media/13667/ugs_ar_gr-web.pdf (accessed October 22, 2020)