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Dissertation Topic: Cyprus Economy (sector: oil and gas)

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Summary:

Natural gas and energy in general, is a sector that might have a huge impact on the economy of a country. This is what is also expected for Cyprus as the discoveries of natural gas allow the country to dream that this sector will be a game changer for the country's economy. Currently, services, tourism, and maritime transportation are the three pillars of the Cypriot economy. These three sectors contribute more than 80% on the GDP and employ also about 80% of the active population. When Cyprus will be in the position to start exporting natural gas to other countries, these GDP allocations are expected to be shifted as the profit expected from natural gas exploitations is estimated to be remarkably high and many new job positions are expected to open.

There are many obstacles in Cyprus's way though to make this dream come true. For this reason, the dissertation will not be analyzing only the energy sector in the economy, but it will also emphasize on the geopolitical impact this sector will have as these two elements are corelated, and they also affect the decisions the country needs to make in order to make the most beneficial choices. According to specialists, Cyprus will start earning profit from this sector in 8-10 years from today, therefore this research will be mostly a conjecture about how oil and gas will affect the economy of Cyprus in the near future.

On July 9th, 2020, a foundation laying ceremony of LNG installations in Vasilikos took place. The total cost of this project is estimated to be around €289 million. One of the key questions that will be attempted to be answered under this study, is if the decision of the government of Cyprus to proceed with the construction of an LNG terminal is the right approach or if it should have proceeded with other alternative options.

Περίληψη:

Το φυσικό αέριο και γενικότερα ο τομέας της ενέργειας, είναι ένας τομέας που μπορεί να έχει τεράστιο αντίκτυπο στην οικονομία μιας χώρας. Αυτό αναμένεται να συμβεί και στην Κύπρο, καθώς οι ανακαλύψεις του φυσικού αερίου επιτρέπουν στη χώρα να ονειρεύεται ότι αυτός ο τομέας θα φέρει μεγάλες αλλαγές στην οικονομία της. Επί του παρόντος, οι υπηρεσίες, ο τουρισμός και οι θαλάσσιες μεταφορές αποτελούν τους τρεις πυλώνες της κυπριακής οικονομίας και αυτοί οι τομείς συμβάλλουν περισσότερο από το 80% στο ΑΕΠ και απασχολούν επίσης περίπου το 80% του ενεργού πληθυσμού της χώρας. Όταν η Κύπρος θα είναι έτοιμη να εξάγει φυσικό αέριο σε άλλες χώρες, οι κατανομές του ΑΕΠ αναμένεται να μετατοπιστούν καθώς το αναμενόμενο κέρδος από την εκμετάλλευση του φυσικού αερίου εκτιμάται ότι είναι εξαιρετικά υψηλό, όπως και επίσης εκτιμάται ότι θα ανοίξουν πολλές νέες θέσεις εργασίας.

Υπάρχουν όμως πολλά εμπόδια στον δρόμο της Κύπρου για να μετατρέψει αυτό το όνειρο σε πραγματικότητα. Για το λόγο αυτό, η διατριβή δεν θα αναλύει μόνο τον οικονομικό αντίκτυπο του ενεργειακού τομέα στη χώρα, αλλά θα ασχοληθεί επίσης με τον γεωπολιτικό αντίκτυπο του τομέα αυτού στη χώρα, καθώς αυτοί οι δύο τομείς σχετίζονται με τις αποφάσεις που πρέπει να ληφθούν προκειμένου η χώρα να προχωρήσει στις πιο συμφέρουσες επιλογές . Σύμφωνα με τους ειδικούς, η Κύπρος θα αρχίσει να έχει κέρδη από τον τομέα της ενέργειας σε περίπου 8 με 10 χρόνια από σήμερα, επομένως αυτή η έρευνα θα είναι ως επί το πλείστων ένας υπολογισμός για το πώς το φυσικό αέριο θα επηρεάσει την οικονομία της Κύπρου στο εγγύς μέλλον.

Στις 9 Ιουλίου του 2020, πραγματοποιήθηκε η τελετή κατάθεσης του θεμέλιου λίθου για το τερματικό υγροποίησης φυσικού αερίου στο Βασιλικό. Το συνολικό κόστος αυτού του έργου εκτιμάται περίπου στα 289 εκατομμύρια ευρώ. Ένα από τα βασικά ερωτήματα που θα επιχειρηθεί να απαντηθεί στο πλαίσιο αυτής της μελέτης, είναι εάν η απόφαση της κυπριακής

κυβέρνησης να προχωρήσει στην κατασκευή ενός τερματικού ΥΦΑ είναι η σωστή προσέγγιση ή εάν θα έπρεπε να είχε προχωρήσει με άλλες εναλλακτικές επιλογές.

Table of Contents

Chapter 1
Introduction

1.1 Generic review

This dissertation will focus on the Cyprus economy, especially in the energy sector. To understand the impact of this sector in the economy of Cyprus, firstly a brief analysis about the country's economy through the years will be presented to provide to the reader useful information about the transformations the economy went through the years, the current economic status of the country, the main economic sectors of Cyprus and why natural gas might be a "game changer" in Cyprus economic profile. Retrospection of natural gas in Cyprus from 1980 until today will also be performed to help the reader understand the steps followed in the past until today and at what is the status of the natural gas project now. A comparison between energy and the other main sectors of Cyprus economy will also be performed. It is important to be mentioned at this point that Cyprus has not yet started to have any profit from natural gas. According to specialists, the country will start earning profit from it after 8-10 years from today, hence this research will be mostly a conjecture about how natural gas will affect the economy of Cyprus in the near future. Studies which provide useful data about how natural gas affected other countries will also be presented in this dissertation to help the reader understand the impact this field can have on the economy of a country and also compare the impact it had/has in these countries with the impact it might have in Cyprus.

1.2 Thesis Goals

The main goal of this research is to analyze Cyprus economy and the impact of natural gas on the economy. This sector is considered particularly important since it is expected to play a major role in Cyprus economic growth. This fact makes the dissertation equivalent important because it will provide useful information to the reader in an effort to understand the potential impact of this sector in the economy. What also makes this dissertation interesting is the fact that there is not a complete research conducted so far that provides the information that can be found here. What this dissertation will try to achieve is, step by step, chapter by chapter, help the reader understand the full picture about what natural gas is, what are the steps Cyprus economy went through the years, so later the impact of natural gas on the economy can be comprehended, it explains terminologies related to the field, the history of natural gas in Cyprus, it provides comparisons between Cyprus and other countries and compelling analysis from specialist on the field. Last but not least, a data analysis from the data collected during this research will be performed to extract useful results for the energy sector in the country.

Most observers believe that Cyprus has a rare economic outlook ahead of it, but it can hardly be exploited immediately. How fast and how much the profits will be is still unknown. In the short term, it is likely to play a greater role as a bargaining chip than as a factor of immediate economic growth or recovery, but this fact is also important because it will encourage critical foreign investment. In the next chapters, academic articles, interviews with specialists published in newspapers and data analysis of data collected will be presented to help the reader understand the future impact on the economy and the risks and hazards Cyprus might face on its way of trying to make oil and gas a major profitable sector. The biggest obstacle is the continued acts of provocations from Turkey. Turkey is trying to create a blockade around Cyprus, trying to coerce Cyprus over energy in an attempt to put the issue of hydrocarbons on the “discussions table.” Turkey insists on drilling inside the Cyprus Exclusive Economic Zone and threatens Cyprus with a

second invasion, noting that it is not going to back down in its claims in the eastern Mediterranean. Another obstacle is the environmental regulations set from the EU due to the climate change. The EU is aiming to make Europe climate neutral in 2050 by putting in effect the green deal. “The green deal will work through a framework of regulation and legislation setting clear overarching targets – a bloc-wide goal of net zero carbon emissions by 2050, and a 50%-55% cut in emissions by 2030 (compared with 1990 levels) are supposed to be at the core – alongside incentives to encourage private sector investment, with action plans for key sectors and goals such as halting species loss, cutting waste and better use of natural resources.” (Harvey & Rankin, 2020)

Therefore, Cyprus government must be well prepared, and it must design an effective and proactive plan regarding the exploitation of natural gas resources. Another obstacle that has emerged recently, at the beginning of 2020, it is the pandemic caused by Covid-19 that has severely affected the oil and gas industry. “Oil and gas field has taken one of the biggest hits due to Covid-19. The virus forced many oil and gas companies to stop or slow down their physical operations for a long period of time, which has impacted the production in upstream and downstream operations. Probably the largest and most significant impact of the Covid-19 pandemic on the downstream oil market has been the price crash of crude oil within a short time. Oil companies have taken a major hit. For example, BP's market cap in July 2020 is just 51% of what it was at the start of 2020.” (Wood, 2020)

1.3 Key Research Question

The key questions that are going to be answered under this dissertation are how natural gas will affect the economy of Cyprus and if the decision to proceed with the LNG terminal in Vasilikos is a beneficial solution for Cyprus or not based on the facts that are known until today. To answer these questions, a comparison will be made between Cyprus and other countries where one of

its main economic sectors is oil and gas (such as Israel and Egypt). To help the reader understand the impact this sector might have in the economy, firstly an analysis of Cyprus economy will be displayed to show the phases Cyprus economy has been through, the transformations it went through, the type of the economy and what is the current economic status of the country. In order to answer the question of whether the construction of the LNG terminal is a beneficial solution for Cyprus, data collected during this study will be used for data analysis.

1.4 Thesis Structure overview

The thesis is organized in 7 chapters. The first chapter is basically the introduction, and the purpose of this chapter is to prepare the reader with a short introduction explaining what will be followed in the next chapters. For example, the goals that is aiming to achieve and the key questions that are going to be answered in this study. In Chapter 2, the literature review will evaluate the literature and list studies from where the information to create this research is coming from and studies from where later the data will be compared and analyzed. Chapter 3 presents the theoretical background on which the research topic is based on. It is divided into sections that develop the importance of the natural gas sector in Cyprus, it explains the terminologies and abbreviations that will be used in the dissertation. Chapter 4 presents the type of this research, the methodology, and the ways that were used to collect the information. Chapter 5 describes the research data collected and it is an attempt to analyze the results that emerged after the analysis of the information collected through the research. Chapter 6 is illustrating the results that were extracted from the data that were previously collected on Chapter 5. The final chapter (Chapter 7) will present the final conclusions that emerged from the results of the research, and it presents the epilogue of the research.

Chapter 2
Literature Review

A research utilizes the existing scientific knowledge and research data. “A research does not start from point zero. The existence of a bibliographic background proves that the researcher has studied the relevant literature and has sufficiently developed the theoretical background. The systematic study of the research that has been conducted in a specific field concern.” (Kothari, 2004):

(a) The presentation of the bibliographic sources studied by the researcher
(b) The critical appraisal the bibliographic sources so the researcher to get a clear picture of the subject to be explored and to highlight the research "deficit"

The type of materials examined in this dissertation are coming from interviews conducted by specialists on the field published on newspapers, from scholar resources, from official websites of the government of Cyprus and from professional science sources. In addition, it was decided to investigate how oil and gas sector affected other countries related to Cyprus. The ways in which natural gas affects economy studies in many countries around the world were done. In Cyprus, at the time of writing, no such completed study has been conducted to demonstrate the level of impact of this sector in Cyprus economy. This chapter will list some of the studies conducted in other countries like Israel, Egypt and Turkey with the results and conclusions drawn by the researchers. These studies are based on data collected by the researchers.

2.1 Natural gas in Israel

The first country selected to be examined is Israel. This country was chosen because like Cyprus, Israel is also located in the eastern Mediterranean, and because Cyprus, Greece and Israel signed an agreement to build a 1,900 km EastMed on January 2, 2020. EastMed is a subsea pipeline and the purpose it will serve is to transfer natural gas from the eastern Mediterranean area to Italy, and from Italy the gas will be distributed in other European countries. The "Natural Gas Revolution" is a research written by Israel Shmuel Even and Oded Eran on 2013 - 2014. This research will help the reader learn useful information about Israel's natural gas revolution regarding the three waves that it was developed, the impact on the economy and the obstacles that were found on the way. According to Shmuel Even and Oded Eran (2014), the Israeli natural gas revolution developed in three waves. The first wave started in 1999-2000 with the natural gas discovery in commercial quantities in the gas field Mari B and. The regular gas delivery started in 2004, and in the last years those reserves have been depleted. The second wave started in 2009 with the discovery of natural gas in the initial drilling in the Tamar plot. The gas flow from this field enabled the continued supply of Israeli gas to the economy and it will continue to be a central supplier for the economy's needs in the following years. The third wave started in 2010 with the discovery of gas in Leviathan, Tanin, Shimshon and Qarish fields. With these discoveries Israel became a potential gas exporter. For export, suitable infrastructure must be constructed for example pipelines or LNG installations. The development of relatively advanced technologies that enable deep water drilling, big investments from the Israeli business sector, institutional investors, and foreign investors who purchased units of partnership made the natural gas revolution in Israel possible. In 2002, natural gas delivery pipelines were built in the country. The INGL - Israel Natural Gas Lines, a corporation owned by the government, was licensed to construct, and operate the delivery system. So far, natural gas has mainly replaced diesel, oil and coal at power stations and industrial plants. There are also plans to use natural gas for

transportation and as a replacement for cooking gas. Table 1 shows the growth of natural gas supply in Israel over the past 10 years.

Table 1: Natural Gas Supply in Israel

Year	BCM
2004	1.2
2005	1.6
2006	2.3
2007	2.7
2008	3.8
2009	4.2
2010	5.3
2011	5.0
2012	2.6
2013 (forecast)	7.8
2014 (forecast)	8.6

Economic advantages: Natural gas is the least expensive energy product in Israel. In May 2013, according to the Natural Gas Authority, the price of diesel per energy unit is 3.5 times higher than the price of natural gas, the price of oil is 2.25 times higher, and the price of liquefied petroleum is 3 times higher. Natural gas usage in 2004-2012 saved the economy 22 billion shekels. In addition, the construction cost of a power station operated by natural gas is much cheaper than a coal power station and requires a smaller area. The contribution of the gas sector to the Israeli GDP growth, estimated by the OECD, will be 1% in 2013 and 0.7% in 2014.

Reduction of Israel's dependence on foreign energy: Over the next decade, natural gas will become Israel's main source of energy, and the increase in the demand for energy for industry, electricity production and transportation will be supplied by natural gas. According to the Natural Gas Authority, the natural gas systems must be treated as critical economic infrastructures. This event means, the country cannot be satisfied with matching supply to demand, but it must make sure there is surplus supply, to supply systems for the economy. The reduction of energy

dependency is extremely important for many countries in the world. This idea is particularly beneficial for Israel because it is located in the Middle East, and the supply lines to it are narrow and limited. On the economic perspective, the dilemma for Israel was split on two main variables that work in opposite directions. Gas benefits can be distributed as follows: keep oil and gas in the sea floor for domestic consumption only, so that the future generations can use it based on their needs; or use the gas to provide for all current domestic needs and export the rest until the fields are exhausted. The first variable is the price of gas in the future. Based on forecasts, gas prices are expected to rise in the future. The second variable is the return on capital accruing from the sale of gas in the present. The higher the projected return based on forecasts, the more beneficial it is to export the gas and invest in the economy will be larger. To ensure the priority for the purchase from the fields under Israeli control, the committee decided that the fields will be indebted to supply a certain quantity of natural gas to the domestic economy. Regarding exportation, the committee decided that owners of holdings will have to receive further approval to sell the gas that is not intended for the domestic usage. The Zemach Committee concluded that the total quantity of gas in the Mediterranean Sea should be extracted and divided between domestic use and exportation over the next 25 years. The domestic gas demand will be met by a total of 500 bcm, and the rest 450 bcm will be exported. Employing a long-term economic view, it will not be profitable, because of the significant loss of direct income to the state. On June 23, 2013, the government decided to approve the calls to increase the quantity of gas to be used for the domestic economy and to reduce the exportation. It decided that Israel will keep about 540 bcm (57%) of its potential gas reserves for domestic use, in other words an extra 90 bcm, or an additional 3-4 years of consumption for the economy of Israel.

Table 3: Demand Scenario for Natural Gas in Israel

Year	BCM
2015	9.7
2020	13.3
2025	16.6
2030	20.6
2035	23.4
2040	27.1

The question of gas exports to Turkey, as a consumer and as a distribution channel, is a sensitive diplomatic issue. There is an unresolved tension between Turkey and Israel, and both Israel's government and the private sector, including Israeli and foreign companies, will need to find solid guarantees before turning to Turkey for gas exports. Potential partnerships with Cyprus and Greece in infrastructure and transportation are especially important, mainly because these two countries are EU members, and both countries are located in the eastern Mediterranean. Other potential export markets such as China and India hold diplomatic importance, but the potential of exporting to these countries is small in comparison with the huge energy consumption of these countries and the fact that the quantities of Israeli export would be the smallest in the world gas industry.

2.2 Natural gas in Egypt

The next country that was selected to be examined is Egypt. Similarly to Israel, Egypt is also located in eastern Mediterranean. The relations between Cyprus and Egypt especially in the energy sector are particularly good and one reason which proves this is that the two countries progressed discussions to build a marine pipeline between the two countries to transfer natural gas from Cyprus (Aphrodite block) to Egypt and then re-export it from there.

According to Karim Hegazy (2015), in early 2000, Egypt appeared as a big exporter and producer of natural gas. Egypt started to move to natural gas to replace oil on the local market, mainly to provide fuel for power plants and heavy industries to avoid wasting more chemical oil for export. Until 2011, about 18% of natural gas production was exported. It is important to mention that this research was done before the discovery of Zohr. Zohr was discovered in 2015 by ENI (an Italian energy company) and it is the largest ever natural gas discovery within the Mediterranean area. Since 2011, natural gas production in the country has declined by a lot. The decline was approximately 3% from 2009 to 2013. Meanwhile, the country's gas exports have declined significantly by 30% per year from 2010 to 2013. This happened not only due to the decrease of production of natural gas, but also due to the massive rise in local demand for natural gas, mostly in the power sector. From 1990, the government motivated businesses, households, and industries to consider natural gas as replacement for diesel products. Therefore, the consumption increased by 7% per year, and as a result Egypt started to import LNG to satisfy the needs.

A dept of about $7.5 billion is owed to foreign operators by Egypt as of June 2014. Some of these foreign operators have reduced their investments on their projects. However, the post-revolutionary disruption in Egypt has only increased the severity of the existing long-term deficiencies in the Egyptian energy sector, which have persisted for at least 10 years. However, successive governments have inherited a blocked gas sector due to the conflicting demands of the country's growing domestic energy needs and existing export contracts with customers in Egypt. An additional factor that contributed to prevent natural gas production was the low price the government paid to foreign operators, which was a major barrier for operators interested in investing in the Egyptian energy sector, as these prices made these projects economically unprofitable for many. The history of extremely low domestic energy prices has systematically changed the country's domestic energy market, resulting in exceptionally low levels of industrial

energy efficiency and consequently, wasteful energy consumption, both by energy-intensive industries and high-level energy users. Energy consumption has forced the government to shift an increasing part of its natural gas production to the domestic market, where domestic prices are low and international prices are high.

After the 2014 presidential election, Egypt has made significant progress in terms of political stability and economic growth. The government has taken decisive steps to stimulate the energy sector and the economy, including paying debts to international oil and gas companies to accelerate the development of the existing gas field; encourage new explorations; it extended the LNG import contracts until 2020. These laws include accelerating natural gas connections in residential areas and allocating savings to encourage social spending.

For example, in March 2015, BP signed contracts for a $12 billion project to extract natural gas. This reflects the vote of confidence in Egypt's investment and economic potential. The low gas price raises doubts about gas export and at the same time it reduces the interest of the investors in the gas sector. This requires Egypt to review its gas policies, especially if the government tries to isolate the interest of the investors from domestic gas prices. In the long term, Egypt is trying to reverse the decline in gas supply by encouraging deep-sea exploration under better conditions. In the meantime, it is aiming for the country's first LNG imports to make up for the deficit. Agreements have already been signed to import 81 LNG shipments over the next two years. Egypt is also aiming for a long-term supply agreement with Russia.

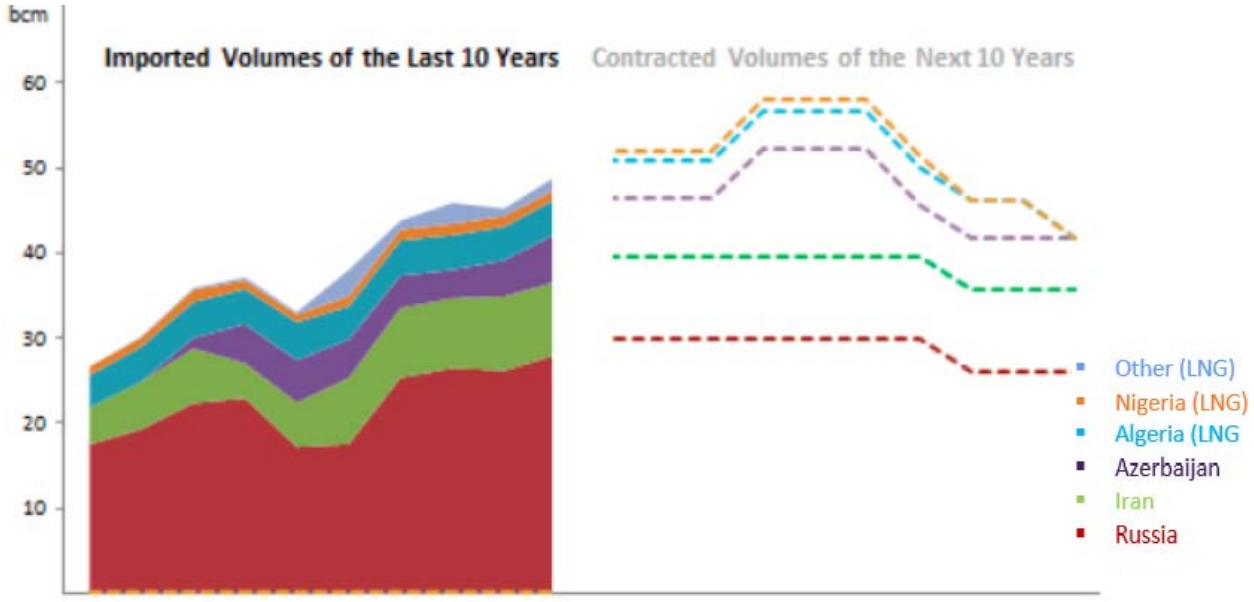
2.3 Natural gas in Turkey

The last country selected to be examined is Turkey. There are several reasons and some of them obvious why Turkey was selected but the most important one is because like it will be analyzed later on Chapter 5, Mr. Ellinas stated that Cyprus should consider the option of exporting natural

gas to Turkey. Ole Gunnar Austvik and Gulmira Rzayeva (2016) wrote a paper with the subject of "Turkey in the Geopolitics of Natural Gas." The reason why this specific research was chosen to be included in the bibliography review section is because it is analyzing not only the economic impact of natural gas in Turkey but the focus of this research as the title reveals is on the geopolitical impact of natural gas in Turkey and this is an interesting part to be analyzed in relation with Cyprus geopolitics.

According to Ole GunnarAustvik and Gulmira Rzayeva (2016), Turkey is an increasingly gas consuming country and a country which is strategically located among main consumption areas like Europe, and it is also located close to many suppliers like Russia, Middle East and Asia. This makes Turkey a country with a high transit value. Turkey can transfer a greater amount of natural gas from the Middle East (e.g., Israel, Cyprus) to Europe through the TANAP pipeline, which has been in operation since 2018. But for Turkey, the problem is that the financial, infrastructure and political situation as well as bad relations with neighboring countries limit this potential.

Both Cyprus and Israel are expected to become new exporters of natural gas in the Eastern Mediterranean in the following years. After the settlement of the Cyprus reunification issue, and if the diplomatic issues between Israel and Turkey will get resolved, approximately 10 to 20 bcm of natural gas can be transported to Turkey through the pipelines of Israel and Cyprus each year. Entering a large and growing market at a reasonable price can make the Leviathan oil field in Israel economically feasible and justify the construction of an underwater pipeline to Turkey through Cyprus. Turkey is the second largest gas buyer of Russia's gas. Therefore, Russia not only wants Israeli natural gas to enter the Turkish market, but it may also want to enter the European market through Turkey. This fact seems to play an important role in Gazprom's repeated attempts to enter the Israeli gas market and upstream projects.



Source: Okan Yardimci, Energy Expert, Energy Market Regulatory Authority (EMRA) of Turkey

The energy sector is one of the most important issues for the relationship between Turkey and the European Union. Turkey's role in natural gas geopolitics is determined by the country's internal situation, as well as the evolution of the political environment and Turkey's relationship with it, and how the transit routes for the Turkish government have set several strategic objectives, including liberalization and the creation of a competitive internal market for natural gas, and ensuring security of gas supply. Turkey is also trying to eliminate the budget, as well as to change risks and investment responsibilities. Ultimately, Turkey hopes to become an international natural gas trading center that will act as a bridge for the flow of hydrocarbons from east to west. Russia's TurkStream can ease this problem in the region of the country, and TANAP can also alleviate this problem when it is put into operation in 2018 and it can increase the regasification of LNG. If the solution is to proceed with the TurkSream, then both Turkey and the EU will rely more on Russian natural gas. Therefore, Turkey's relations between the EU and the United States, on the one hand, and Russia, on the other hand, need to be balanced in addition

to the relations with the countries in the Central Asia, Middle East, and the Mediterranean, which may be important to Turkey in terms of the role of the country as a natural gas consumer and as a transit country.

2.4 Natural gas in Cyprus

On the studies above an analysis was provided for countries related with Cyprus on the energy field and the impact of natural gas has on these countries on the economic and the geopolitical section. In the following sub-sections, research on the Cyprus gas field will be introduced. These studies are analyzing the potential of Cyprus to become an exporter and the options the country should consider, the energy security prospects and lastly the connection between the recent hydrocarbon discoveries with the relationship between Cyprus, Israel, and Turkey and how the energy sector was used as leverage to push for more a favorable peace settlement between Cyprus and Turkey.

2.4.1 Natural gas in Cyprus: The need for consolidated planning

The main topic of this research is about the electricity supply system of Cyprus. The system is currently mostly covered by oil-fired generation. The contribution of the renewable energy technologies in the electricity supply system is small but it is slowly increasing. The regulation for greenhouse gas emissions is becoming stricter especially in the EU, therefore an immediate change in the system is mandatory. Natural gas reserves found in Cyprus, and the possibility of more natural gas imports can possibly be the substitution of oil with gas in the near future. Nevertheless, the framework under which the changes could be occurred has not yet been confirmed. Some of the questions answered on this research are, should imports of natural gas serve as an interim solution until domestic gas becomes available in the country? What are the infrastructure issues associated with such a temporary solution? How does the shift from oil to

gas will affect energy security and how appropriate will be with a liberalized electricity market? Can the interim and the long-term strategies be consistently designed and implemented?

The method that was followed in this research to answer these questions is based on a cost-optimization model representing the electricity system of the island. Different scenarios were run to provide results as of the generation mix, the capacity and system costs. In all the test-cases that were investigated, the compliance with environmental regulations of the European Union after 2020 which makes gas the strategic fuel of choice for low-cost electricity generation was considered. (Taliotis et al., 2017)

2.4.2 Natural Gas Export Options for Israel and Cyprus

Based on the research conducted by Henderson S. (2013) 'Natural Gas Export Options for Israel and Cyprus', the recent discoveries of natural gas in Israel and Cyprus give to both countries the opportunity to become exporters in Europe, Asia or both. As the title of the research reveals the goal of the research is to provide information regarding the discoveries of natural gas in the countries of Cyprus and Israel, the steps the countries should take in order to become succesful exporters, the diplomatic challenges the countries are facing and the prospect of cooperation between the countries for a successful exploitation of the discovered reserves.

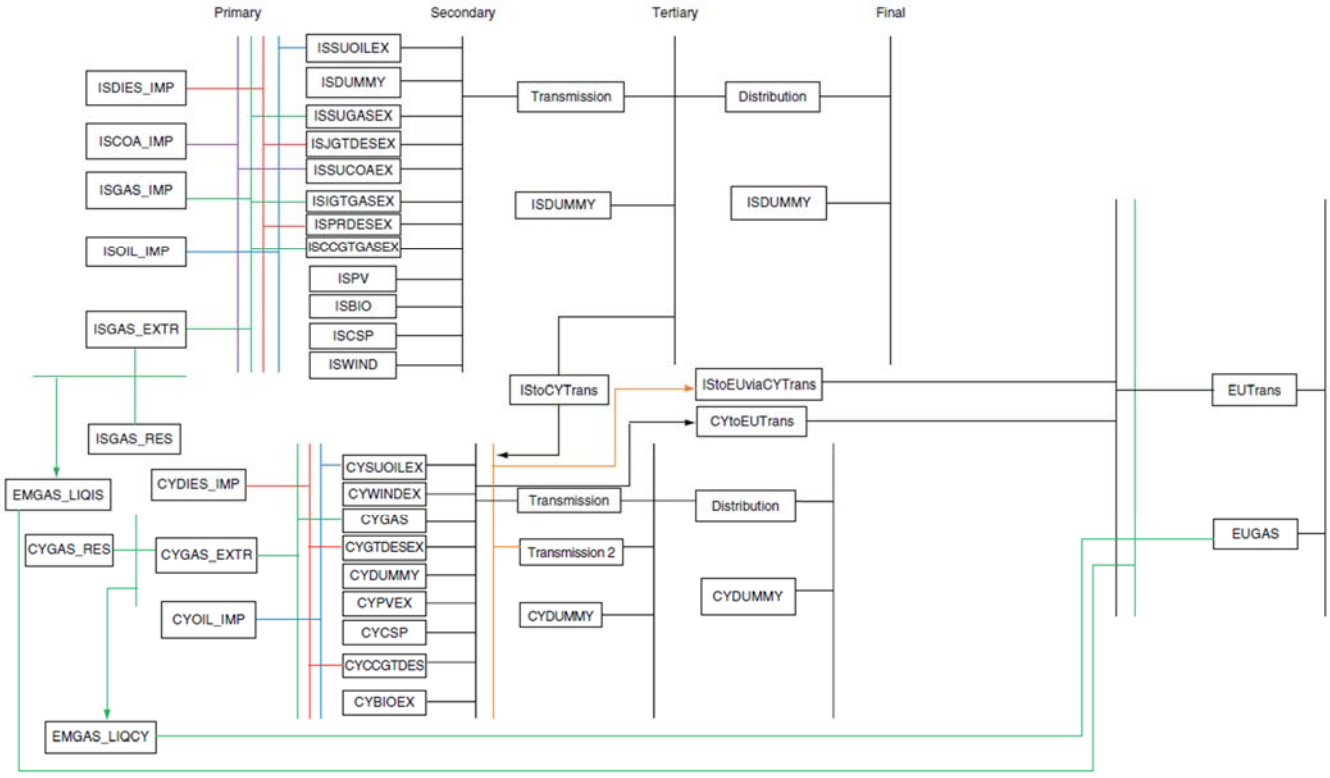
The natural gas discoveries in both countries offer an opportunity to strengthen their energy security and to grow their economies. However, Eastern Mediterranean area contains many political, commercial, and geopolitical challenges. As illustrated in this research, a potential option for Israel is to export a part of its surplus gas to Palestine and Jordan, but this option is blocked by many diplomatic issues. Thus, the most beneficial option for both Israel and Cyprus is to convert the gas, which is surplus to domestic requirements into LNG and then export it to potential buyers in Asia and Europe. The downside of this option, is that it requires a huge long-

term investment at an era where natural gas prices are weakening and other allied countries like Egypt and Lebanon, are in domestic political instability. But there is no need for a single solution, the solution could be to develop numerous options. For example, to build pipelines to connect both countries with neighboring countries and to construct an LNG terminal in Cyprus and then export it to Europe. One major benefit of the LNG export for Israel and Cyprus would be the avoidance of an undue reliance on a fixed connection with Turkey. However, multiple export options presuppose that present political obstacles will be resolved and that enough gas will be discovered to ensure the commercial viability of both LNG process and the construction of the pipelines. Currently, Israel is leading the delineation and exploitation of its much larger fields, while Cyprus is being hampered by the ongoing effects of its financial crisis.

2.4.3 Energy security prospects in Cyprus and Israel: A focus on natural gas

According to Taliotis (2014), the worldwide production of natural gas has been increased by 267.7% from 1973 until 2010 (from 1226 bcm to 3282 bcm). The increase in the production is estimated to continue by the rate of 1.6%/year between 2010 to 2035. Important natural gas discoveries have recently been made in Israel and Cyprus. The energy needs of both countries - mostly due to their small population- are relatively small, therefore the natural gas discoveries can fully supply energy for the two countries for the next 30-40 years and still export a huge volume of the gas. In this research, the MESSAGE model (Model for Energy Supply Strategy Alternatives and their General Environmental impacts) was used to inspect a possible interaction on the energy system of these two countries. In this research scenarios are being analyzed, to evaluate the capability of a potential exportation of electricity that is generated by gas-fired power plants, gas to liquid products and liquefied natural gas. The results of these scenarios demonstrate the economic benefits that will appear from the exploitation of the gas resources in the two countries.

Considering the increase on demand for energy in the next years, and while further discoveries of fossil fuel are coming to the surface, new strategies will need to be invented by the two countries to get the maximum benefits. Israel imports large volumes of fossil fuels, despite the ongoing natural gas extraction, while Cyprus relies almost entirely on imports; European Union, is searching to exploit resources coming from the EU members and promotes diversification of supplies and this creates a nice opportunity for Cyprus to consider the EU as its main importer. "This research aims to add to the existing literature in regard of the quantitative assessment of the future development potential of these resources in Israel and Cyprus. The methodology followed in this research was the quantitative analysis of power generation and gas export capabilities of the two countries under a range of scenarios. Considering the financial crisis that has recently hit hard the island of Cyprus, the results were presented of the analysis of how these reserves may affect the power generation system of both countries over the coming decades and whether there is any grave prospect for exports." (Taliotis et al., 2014)



Source: International Journal of Sustainable Energy Planning and Management Vol. 03 2014

2.4.4 Eastern Mediterranean Natural Gas: Potential for Historic Breakthroughs among Israel, Turkey and Cyprus

This study is focusing on the relationship between Turkey, Israel, and Cyprus in with regard to the hydrocarbon resources recently discovered in Cypriot and Israeli EEZ. According to Bryza (2013), the recent major discoveries of natural gas in both countries could be a great opportunity to reconfigure the geopolitical shape of the Eastern Mediterranean area. If these discoveries are managed in a strategic and diplomatic manner, they will provide opportunities for Cyprus and Israel to achieve energy independence while the two countries are still highly dependent on energy. In addition, these discoveries can provide important economic growth opportunities for

the two countries and help them on the efforts they make to resolve major diplomatic issues with third countries (e.g Turkey). They might also provide a good opportunity to finally resolve the ongoing conflict between Cyprus and Turkey. In this research, it is said that "an LNG terminal could elevate Cyprus's strategic importance by enabling it to emerge as a natural gas transit hub for the Eastern Mediterranean; and an agreement to develop a Cypriot LNG terminal thanks to an Israel-Turkey pipeline would radically improve the political mood between Cyprus and Turkey. Politically, an LNG terminal could elevate Cyprus's strategic importance by enabling it to emerge as a natural gas transit hub for the Eastern Mediterranean. This, in turn, would boost Cyprus's relations with Israel and Lebanon, and perhaps elevate its confidence in UN-led negotiations on a comprehensive settlement of the Cyprus conflict." (Bryza, 2013)

2.4.5 Gas and Reunification in Cyprus: Exploring the Linkages Between the Politics of Natural Gas and the Peace Talks in Cyprus

Similar to the above research, this research is also concentrated on the relationship between Cyprus and Turkey in relation of the exploitation of the hydrocarbons. It is analyzing the conflict between the two countries, the energy sector and how the discussions between the two countries were affected after 2011, when Cyprus announced the discovery of natural gas in the 'Aphrodite' Block. "While over the years they have broken down over similar causes, their dynamics, progression, and outcomes have also been influenced by new and external developments. Using McAdam and Fligstein's theory of fields and a method of 'explaining outcome process tracing' this research asks how the politics surrounding Cypriot gas, involving the two governments in Cyprus as well as the Turkish government, has affected the Cyprus talks between 2011-2017. It is found that gas has incentivized the recontinuation of the Cyprus talks in 2014, but also that political contention over the rights and ownership of gas have had a predominantly negative effect on the progression of peace talks. That contention has repeatedly damaged mutual trust between parties, negatively affected the atmosphere at the negotiation table and caused negotiations to come to a standstill. Lastly, it is found that the issue of gas has

been used by parties as leverage to push for more a favorable peace settlement." (Oosterholt, 2019)

2.4.6 Contribution to the existing literature

An analogous research method with the studies above is followed in this dissertation to organize, demonstrate and analyze the data collected for Cyprus, to complement the existing studies with more updated information since most of the studies above were conducted few years ago. In addition, this study will add to the existing literature an evaluation on the government's decision to proceed with the construction of the LNG terminal in Vasilikos by taking into consideration the discoveries of natural gas until today, and by analyzing the strategic prospects of this decision.

The data collected are firstly organized and then analyzed to increase the understanding on the topic by providing useful information to the reader. The methods of analysis followed in this study are based on documentation, discovery, interpretation of the results, data analysis, research, and development of methods and systems for the advancement of readers' knowledge. Chapters 5 and 6 will explain the gas sector in Cyprus. Two interviews from specialist in the area of oil and gas in Cyprus published in Cyprus and Greece newspapers will be presented. In these interviews, the specialists provide their thoughts, their concerns, and their opinions as to how Cyprus can get the maximum benefits out of this sector, and how to avoid potential hazards. After these two interviews, an extended analysis of the data collected will be performed to help the reader recognize if the country's decision to build an LNG terminal is an advantageous and viable solution, or if Cyprus should have proceeded with other alternative options.

Chapter 3
Theoretical background

3.1 Natural gas

"Natural gas is a fossil fuel and like other fossil fuels such as coal and oil, natural gas forms from the plants, animals, and microorganisms that lived millions of years ago. There are several different theories to explain how fossil fuels are formed. The most prevalent theory is that they form underground, under intense conditions. As plants, animals, and microorganisms decompose, they are gradually covered by layers of soil, sediment, and sometimes rock. Over millions of years, the organic matter is compressed. As the organic matter moves deeper into Earth's crust, it encounters higher and higher temperatures. The combination of compression and high temperature causes the carbon bonds in the organic matter to break down. This molecular breakdown produces thermogenic methane—natural gas. Methane, probably the most abundant organic compound on Earth, is made of carbon and hydrogen (CH_4). Natural gas deposits are often located close to oil deposits. Natural gas reserves near the surface of the earth are dwarfed by nearby oil reserves. Deeper deposits, which form at higher temperatures and pressures, contain more natural gas than oil. However, it is not necessary that natural gas form very deeply. It can also be made up of small microorganisms called methanogens. Methanogens live in the intestines of animals (including humans) and in low-oxygen areas near the surface of the earth. For example, landfills are filled with decomposing material that breaks down methanogens into a type of methane called biogenic methane." (Turgeon & Morse ,2012)

There are many uses of natural gas. From the early 19th century to the 20th century, natural gas was mainly used for lighting in buildings and streets. Today, modern technology is allowing an

expansion of the uses of natural gas, some of which include Electricity Generation, Heating/Cooling, Cogeneration and Trigeneration and Transportation. According to the U.S. Energy Information Administration, the production and the consumption of natural gas is increasing year by year all over the world.

Production of Natural gas per location:						
	2010	**2011**	**2012**	**2013**	**2014**	**2015**
Gross natural gas						
Africa	14101.35	13931.24	13972.98	13597.16	13789.34	13516
Asia & Oceania	37817.77	18834.58	18988.26	19422.53	20005.72	20484.55
Central & South America	8859.699	8927.624	9128.905	9311.359	9434.882	9549.449
Eurasia	29415.1	30975.21	30666.95	31468.31	30681.92	30837.45
Europe	12816.31	12019.67	12119.6	11660.8	11115.04	10942.75
Middle East	23090.71	24277.16	25323.15	26002.36	26598.09	27064.82
North America	36073.71	37555.1	38189.42	38303.79	40603.79	42002.72
World	162174.7	146520.6	148389.3	149766.3	152228.8	154397.7

Consumption of natural gas per location:								
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Africa	3565.155	4250.937	4526.677	4514.705	4648.478	4677.682	4799.278	5132.966
Asia & Oceania	20720.5	22139.43	23271.82	23881.13	24662.4	24799.25	26028.32	27476.77
Central & South America	4896.642	5065.566	5406.264	5701.638	5809.109	5919.113	5632.885	5618.164
Eurasia	22363.58	23626.51	23132.77	22566.18	22369.37	21555.82	21259.69	22305.06

Europe	20926.93	19465.06	18836.1	18587.1	16906.35	17419.17	18404.47	19282.75
Middle East	13342.47	14142.95	14762.13	15297.54	15981.2	16905.82	17568.81	18088.1
North America	29792.5	30362.83	31681.97	32645.03	33262.9	34053.28	34190.81	34386.4
World	115607.8	119053.3	121617.7	123193.3	123639.8	125330.1	127884.3	132290.2

Source: U.S Energy Information Administration

3.2 Natural gas and environment

Is natural gas considered a clean energy resource? It looks like the perception that natural gas is a clean energy is not valid. According to Union of Concerned Scientists (2014), "Natural gas emits 50 to 60 percent less carbon dioxide (CO2) when combusted in a new, efficient natural gas power plant compared with emissions from a typical new coal plant. Considering only tailpipe emissions, natural gas also emits 15 to 20 percent less heat-trapping gases than gasoline when burned in today's typical vehicle. The drilling and extraction of natural gas from wells and its transportation in pipelines results in the leakage of methane, primary component of natural gas that is 34 times stronger than CO2 at trapping heat over a 100-year period and 86 times stronger over 20 years. Preliminary studies and field measurements show that these so-called "fugitive" methane emissions range from 1 to 9 percent of total life cycle emissions. Whether natural gas has lower life cycle greenhouse gas emissions than coal and oil depends on the assumed leakage rate, the global warming potential of methane over different time frames, the energy conversion efficiency, and other factors. One recent study found that methane losses must be kept below 3.2 percent for natural gas power plants to have lower life cycle emissions than new coal plants over short time frames of 20 years or fewer. Technologies are available to reduce much of the leaking methane but deploying such technology would require new policies and investments."

The impact of natural gas on the environment and the measures some states in U.S take to prevent further damage on the climate is shown in Angst's article (2020). An example is in California, a major city San Jose, bans natural gas in all new buildings as part of the movement towards an era of all-electric energy against climate change. In a national campaign against global warming, San Jose has worked with nearly 20 cities in California that require new buildings to be fully electric. In addition to San Jose, another major city in California, San Francisco has also imposed a natural gas ban on all new buildings.

3.3 LNG - Liquefied Natural Gas

When the natural gas is cooled to -162 At °C, it changes from the gas phase to the liquid phase, and its volume is reduced by about 600 times. In this way, it is easy to carry out large-scale transportation by long-distance oil tanker or special land truck. The liquefaction of natural gas is usually done in a dedicated production unit (LNG liquefaction terminal) that is relatively short away from the production site.

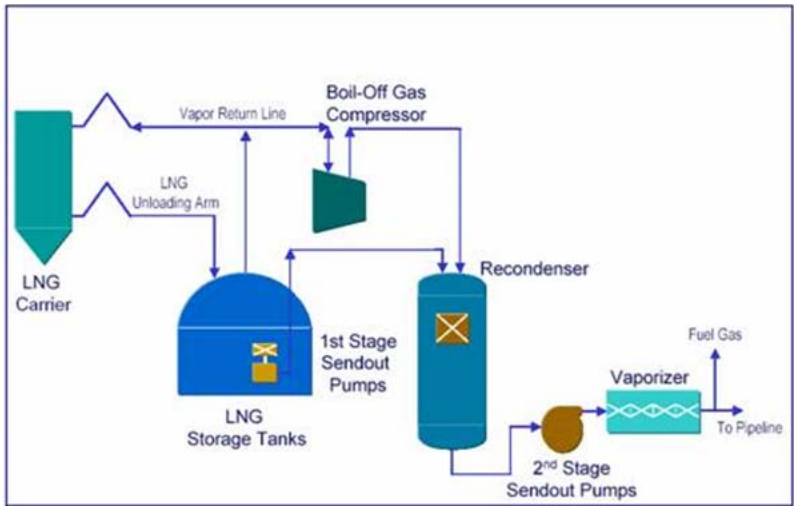
3.4 LNG Terminal

In Kantharia's (2019) article it is explained that LNG terminal is a reception facility for unloading of cargo from LNG tankers. "These ports are particularly used for export and import of LNG. A variety of facilities for unloading, regasification, tanking, metering etc. of LNG are provided at these terminals. Natural gas is transported in liquified state using LNG gas tankers. At LNG terminals, the liquified natural gas is turned back into gaseous state after unloading from ships and then distributed across the network. The activity at LNG terminal can be divided into four main stages."

1. Receiving and Unloading of LNG from ships
2. Storage or tanking of LNG

3. Compression and regasification

4. Transmission



Source: Marine Insight

3.5 EastMed pipeline

The Eastern Mediterranean (EastMed) is a natural gas pipeline project. The energy ministers of Greece, Cyprus, and Israel signed the final accord for the gas pipeline project in January 2020. The purpose of the project is to connect the gas reserves of the eastern Mediterranean with Greece and then to connect Greece with Italy. EastMed will be able to transfer 10 bcm / year to Greece, Italy, and other countries in Southeast Europe on the first phase. The transfer capacity is expected to increase to 20 bcm / year in the second phase of the project. The cost is estimated to be around €5.5 billion, and it has been approved by the European government as a Project of Common Interest.

Source: Euronews

Technical characteristics of the project:

- Length: 1,872 km, of which approximately 1,335 km submarine and approximately 537 km land. Initial Capacity: 10 bcm annually.
- Capacity Expansion: up to 20 bcm annually.
- Budget (for initial capacity): € 5.2 billion

3.6 EEZ - Exclusive economic zone/NAVTEX/Continental Shelf

According to the UN International Law on the Law of the Sea (1982), the Exclusive Economic Zone (EEZ) is the maritime area within which a state has the right to explore or otherwise exploit marine resources, including water and energy production. The EEZ extends beyond the territorial waters of a country to 200 nautical miles from the coastline. EEZ is a simple sovereign right, which refers to the jurisdiction of coastal countries above and below the sea level (seabed and subsoil).

Continental Shelf: According to International Law and the 1980 United Nations Convention, the Continental Shelf is defined as the seabed within a radius of 200 nautical miles from the coast. In some cases, in fact, this radius can be greater than 200 nautical miles, reaching up to 350 nautical miles. Exceptions, according to Article 121 of the 1982 UN Convention on the Law of the Sea, are islets and rocks, which cannot maintain a human population or an autonomous economic life (farming or animal husbandry). These rocks have a coastal zone, but they do not have the right to the continental shelf or the exclusive economic zone. The islands, islets, reefs, and upright rocks, which are surrounded by sea but are not covered by the winter shoreline position, also have a continental shelf. The continental shelf has a great economic importance, as it relates to fishing, hydrocarbon extraction, etc. In addition, because there is often mineral wealth in it or below it (oil, gas, metals), as well as inanimate and living immovable species such as corals, sponges, etc. Hence, there is a strong interest in its exploitation. In any case, however, on both the mainland and the island continental shelf, sovereignty belongs to the state to which the respective coasts belong. The difference between EEZ and Continental is that the continental shelf could generally be considered as a subset of the EEZ but although the seabed and subsoil are included in both zones, for their exploitation International law refers to the provisions of the continental shelf. Therefore, although the continental shelf appears to be a part of the EEZ, it retains its independence in terms of the exploitation of hydrocarbons, which requires the delimitation of both of these maritime zones.

NAVTEX - Navigational Telex: Is an international service designed to disseminate information about maritime and emergency situations in coastal areas on ships. The telex automatically receives and prints the information directly. It is part of the International Coordinated Broadcasting Network (Maritime Safety Information-MIS). MIS has three broadcast services, one of which is NAVTEX.

Chapter 4
Methodology

The purpose of this chapter is to describe the methodology that was followed in this dissertation, and the methods used during the research. Like it was mentioned in the introduction, the main goal of this research is to analyze Cyprus economy and analyze what is the potential impact of natural gas sector on the economy of the country. In order to perform this analysis, the methodology that was used is by using and analyzing existing data. Therefore, the type of this dissertations is "basic research." Based on the Frascati manual (OECD, 2018) "Basic research is experimental or theoretical work that is done with the main purpose of acquiring new knowledge about the fundamental characteristics of phenomena and observable events, without aiming at a specific application or use of these data. Basic research analyzes structures, properties, and relationships with a view to formulating and testing hypotheses, theories, or natural laws. Its results do not offer a direct commercial benefit and are usually published in scientific journals or made available to anyone interested. Basic research is divided into two categories. Pure basic research: Pure basic research is conducted to promote knowledge, without aiming at economic or social benefits or in an active effort to apply the results to practical problems or to transfer the results to areas responsible for their application. Oriented basic research: Oriented basic research is conducted with the aim of producing a broad knowledge base that could form the basis for solving known or expected, existing or future problems or contingencies."

As mentioned in Chapter 2 (Literature Review) the type of materials that are analyzed in this research, are coming from studies that were conducted few years ago for the natural gas sector in Cyprus, from studies that were conducted for the energy sector in other countries related to

Cyprus, interviews from specialists on the field published on newspapers, from scholar resources, from official government resources like the hydrocarbons service of the Ministry of Energy, commerce and Industry and from professional science sources. After the collection of the data, an analysis is performed to extract useful information and results out of the collected data. Like it was mentioned in the introduction one of the key questions that will be attempted to be answered under this research is if the LNG terminal will be a beneficial solution for Cyprus or if the country should have proceeded with alternative options. The method followed to obtain results associated with this research problem is the quantitative method. “Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon.” (Babbie, 2010).

Chapter 5
Analysis

5.1 Overview of Cyprus Economy

Cyprus economy is characterized as small, open and dynamic, with the service industry being the main economic sector. With the complete liberalization of the foreign direct investment system, interest rates were liberalized, and price controls and investment restrictions were lifted. The country has promoted other major structural reforms, covering areas of competence, such as the financial sector and the corporate sector. Cyprus' main trading partners are the EU Member States, in particular Greece and the United Kingdom.

According to the Cyprus Profile (2020), Cyprus gained its independence from the United Kingdom in 1960. In 2004, it became a member of the European Union. Since joining the EU, its economy has undergone extensive structural and economic reforms. Cyprus used to have its own currency, the Cypriot pound (or the Cypriot lira). On January 1, 2008, the Cypriot lira was replaced by the euro as the official currency of the republic of Cyprus. Cyprus was listed by the International Monetary Fund (IMF) as one of the 31 advanced economies in the world in 2016. The economy of the country has been through many shocks throughout its history, followed by impressive recoveries. For example, the 1974 Turkish invasion resulted in a sharp drop in real GDP of 16 in the northern part of the island. The drop was at 9 percent in 1974 and 19 percent in 1975. Hard work and focus resulted in a fast return with growth of 18.2 percent in 1976 and 15.8 percent in 1977, followed by a continued period of strong growth that lasted more than 30 years.

With a share of about 81 percent of GDP in 2011, the services sector is the fastest growing sector. This development shows the restructuring of the Cypriot economy. The GDP share of the manufacturing sector accounted for roughly 17.1 percent in 2011. Agriculture and fishing are constantly shrinking, reaching only

2.4 percent of GDP in 2011. The trade sector is a great contributor to the island's economic development. The significance of this sector can play a major role in the county's effort to build and expand the trade relations with other countries. Because of the small size of the internal market, access to international markets is extremely important for Cyprus. The EU is the primary trading partner of Cyprus. Imports from the EU are estimated to be 68.3 percent in 2011 and domestic exports reached approximately 50.9 percent. The country offers a flattering tax environment, an educated workforce, a strategic location, outstanding telecommunications, modern banking, and legal infrastructure, making it the perfect business partner for the EU and the Middle East.

Cyprus is listed as a high-income country by the World Bank. As mentioned earlier, the Cyprus economy is mainly based on service industries, which account for more than 80 percent of GDP and total employment. When the Eurozone debt crisis was at a pick level (2013), Cyprus requested financial help from the IMF, the European Commission, and the European Central Bank. Cyprus quickly recovered from the €10 billion bailout package and the Eurogroup's controversial and unusual decision to bail out bank deposits. The country pulled out of the plan in March 2016, using only €7 billion of the €10 billion and reduced its debt ratio to less than 100 percent in 2017.

In 2018, Standards Poor's and Fitch Ratings grated Cyprus with a BBB- credit rating to long-term sovereign debt, and this means that Cyprus started to gain back its investment-grade status during that year. After the country's credibility was restored, the economy developed rapidly, with an average growth rate of 4.4 percent in 2015-18. The island was one of the best performing countries in the Eurozone in 2018, with a growth rate of 3.9 percent, while the average growth rate in the Eurozone was 1.9 percent. The growth is driven by strong private demand and employment growth, while tourism demand is the expansion and upgrade of the tourism industry after four consecutive years of record arrivals.

In 2020, there were many challenges, mainly based on the impact of the Covid-19 pandemic. One of the sectors most severely affected by the pandemic is tourism. This has had a significant impact on Cyprus economy because, as mentioned above, tourism is one of the most significant sectors of the Cyprus economy. The figures that prove the sharp drop on the GDP are depicted at the "Table I" below. The government spent 1.3 billion euros to businesses, mostly to support salaries and 1.9 billion euros to support the banking sector. On the positive side, the country will be eligible for the amount of 479 million euros from the European "SURE" program, and 968 million euros from the European Union recovery and resilience facility.

	2018	2019*	2020*
GDP (constant prices)	5.2	3.1	-5.1
Public consumption	3.5	15.1	13.0
Private consumption	4.7	1.8	-3.9
Gross Fixed Capital Formation	-5.2	2.0	-2.1
Exports	8.0	-0.4	-17.4
Imports	4.5	2.0	-5.8
Tourist arrivals (000's)	3,938.6	3,976.8	631.6
Tourist arrivals growth	7.8	1.0	-84.1
HICP	0.8	0.5	-1.1
Labour productivity growth (persons)	-0.1	0.0	-4.6
Employment growth	5.3	3.1	-0.6
Compensation per employee	1.3	1.9	-3.2

Source: CYSTAT

5.2 Main Sectors of Industry in Cyprus

As mentioned above, in the last 20 years the economy has switched from the agriculture to the service sector. According to the Cyprus profile (2020), the agricultural sector supply nearly 1.84% of GDP and employs 3.45% of the country's population. The main crops are grapes, potatoes, and fruits while the agricultural sector is suffering from a dry climate. In 2017, the manufacturing

industry accounted for 11.4% of GDP and employed 16.93% of the workforce in 2018. The manufacturing industry of Cyprus is based mainly on paper, chemical products, textiles, metal products, oil refineries and food processing. The government set as a goal to double the share of manufacturing industry in GDP by 2030. Services, tourism, and maritime transport are the three pillars of the Cypriot economy. In 2018, the contribution of these three sectors was 86.5% of GDP and they also employ 79.4% of the workforce of the country. In 2019, services accounted 82.7% of gross value added, while the industry accounted for 8% construction, 7% agriculture, forestry, and fishing 2.3%.

One newly introduced sector that is estimated to have a big impact in the country's economic growth is energy. The county's good relations with its neighbors, leads the country to have ambitious plans to become a regional energy hub in the Eastern Mediterranean area. A successful exploitation of hydrocarbons could allow the island to export gas to Europe or Asia with the help of the oil and gas industry giants that Cyprus signed agreements with, like ExxonMobil, Total, ENI-Kogas and Royal Dutch.

5.3 Overview of natural gas in Cyprus

In Papavarnava's (2020) article, useful information can be extracted about the history of natural gas in Cyprus. Here are some important events that took place over time:

Natural gas entered the Cyprus agenda in 1980. Specifically, on August 4, 1980, Mr. Ambrose (Senior Director of Standard Oil of Indiana and Amoco) told Mr. Rolandis - then Foreign Minister - that he was interested in investing millions of dollars for exploration and drilling in the sea area south of Cyprus.

In 1982, Cyprus is ratifying the United Nations Convention on the Law of the Sea and establishing the EEZ. UN Secretary, General Kurt Waldheim discouraged Mr. Rolandis to proceed with the

establishment because he was afraid of Turkey's reaction. When Turkey learned about the interest of U.S.A, threatened with further military operation in Cyprus. Turkey's threat, however, did not stop the Republic of Cyprus from ratifying the 1982 UN Convention on the establishing the EEZ.

In 2002/2003, a treaty between Lebanon, Egypt and Cyprus for the delimitation of the EEZ was singed. On March 31, 1998, Mr. Rolandis received the approval for the delimitation of the EEZ with neighboring countries. The country signed the first comprehensive EEZ delimitation agreement with the Egyptian Foreign Minister, Ahmed Maher, on 2003. Mr. Rolandis's work continued after the Republic of Cyprus signed an agreement on the demarcation of the maritime border of the EEZ with Lebanon in 2007. The agreement had caused disturbances with Turkish Cypriot leader Talat sending letters to UN Secretary-General Ban Ki Moon, stressing that the Cyprus agreement with Lebanon undermines the "rights and interests of the Turkish Cypriot side."

On May 4, 2007, the Republic of Cyprus announced the start of the first Hydrocarbon Licensing Round for Blocks 1, 2, 4-12 located in the Cyprus EEZ. The 1st Licensing Round resulted in the granting of a Hydrocarbon Exploration License to Noble for block 12, on 24 October 2008.

On 17 December 2010, the Republic of Cyprus signed an agreement on the delimitation of the EEZ sea border with Israel, which came in effect on February 25, 2011. This agreement led the Turkish Foreign Ministry to announce that this agreement ignores the equal rights of Turkish Cypriots, it has a negative impact on the ongoing negotiations on the Cyprus issue and does not contribute to peace and stability.

On September 19th, 2011, Noble started the first exploratory drilling of Block 12 ('Aphrodite') which was completed in December 2011. When the drilling process was completed, Noble announced an estimate of 7 tcf of natural gas. On one hand, the discoveries were not enough to

make the LNG terminal viable but on the other hand, due to the small number of Cyprus population only less than 10% is needed for the domestic consumption of natural gas and the rest can be exported.

It is indicative that the natural gas discoveries inside the Cyprus EEZ with the discoveries inside the Israeli EEZ upgraded the strategic importance between Cyprus and Israel. The discoveries raised reasonable hopes for the existence of more natural gas fields in the rest of the Cyprus EEZ. On February 11, 2012, the Republic of Cyprus announced the start of the 2nd Hydrocarbon Licensing Round for Blocks 1-11 and 13 located in the Cyprus EEZ. With the 2nd Licensing Round, blocks 2, 3 and 9 were granted on January 24, 2013 to the ENI Cyprus Limited and KOGAS Cyprus, and blocks 10 and 11 on February 6, 2013 to TOTAL E&P Cyprus B.V.

In September 2014, an exploratory drilling on block 9 was started. This time, Turkey issues a NAVTEX to block the exploration process, not allowing the drilling to proceed. The specific NAVTEX cost the negotiations on the Cyprus conflict issue, after Mr. Anastasiadis expressed his dissatisfaction with the violation of the sovereign rights of Cyprus and the temporary suspension of the negotiations. Nevertheless, in November 2014, the Ministers of Energy of Egypt, Greece and Cyprus declared the tripartite cooperation of their governments.

In September 2015, Noble announced the "Aphrodite" block as commercial and in 2016, the 3rd Licensing Round was announced for Blocks 6, 8 and 10 within the EEZ of Cyprus, where it proceeded with the licensing of Blocks 6 in ENI-Total, 8 in ENI and 10 in ExxonMobil / Qatar Petroleum and resulted in a new NAVTEX from Turkey.

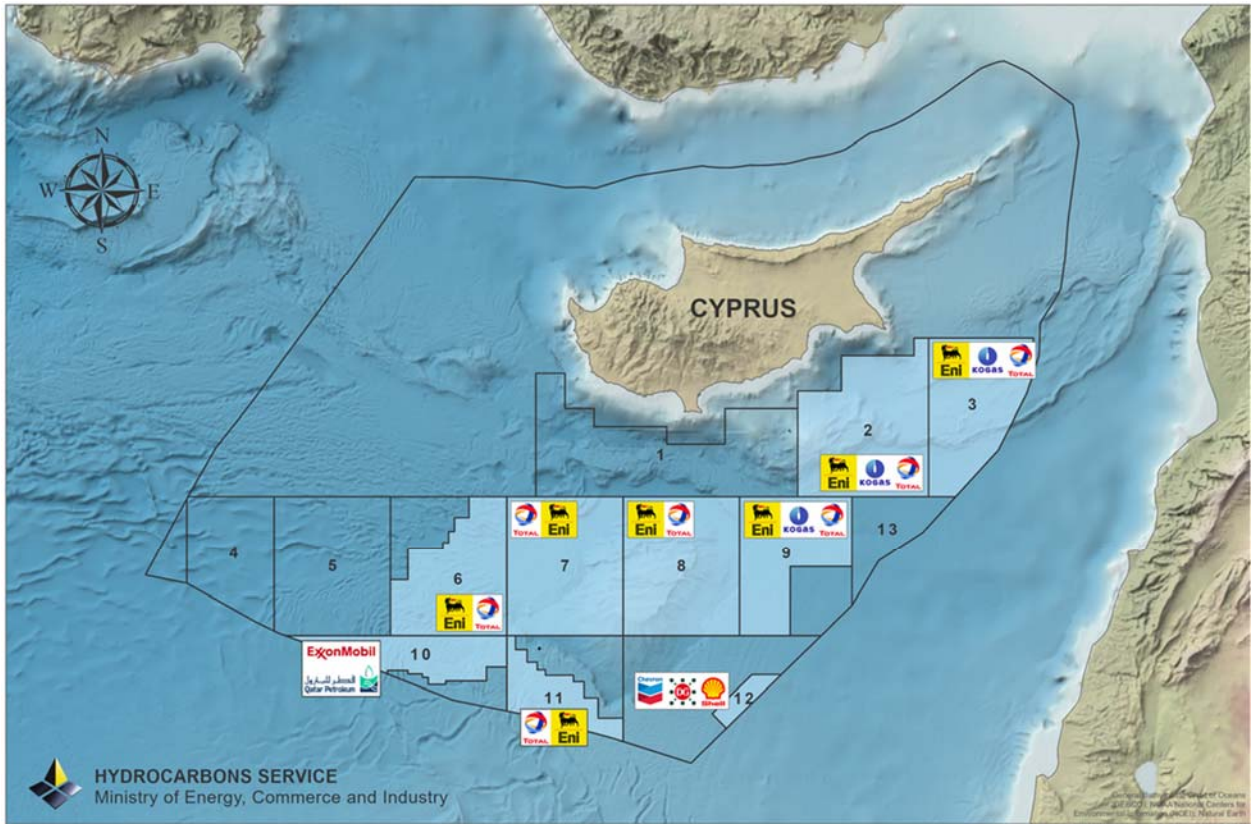
The year of 2017 was a significant year. The Governments of the Republic of Cyprus, Greece, Israel, and Italy signed the memorandum in the presence of the European Commission for cooperation on the EastMed Pipeline Project. EastMed has advantages and a geopolitical interest as it opens a new energy road from Cyprus to the EU, strengthening the energy security of Cyprus,

Greece, and Europe and facilitating the economic development of Cyprus. Also in 2017, TOTAL-ENI drilled on Block 11 ('Onisiforos), where the gas fields are said to be small to medium in size.

In February 2018, after ENI announced Block 6 as commercial, five Turkish military ships blocked ENI, declaring that they were carrying out military activities. This event did not interrupt the agreement between Egypt and Cyprus on a submarine pipeline to connect Block 12 with Egypt and then export it from there. Also, the joint statement of the tripartite meeting Cyprus-Greece-Israel (2018) reiterated their commitment for 'good neighborly relations, international peace and security, respect for sovereignty' and acknowledged the importance of private sector projects, such as the Euro-Asia Interconnector. Also 2018 is the first year that Turkey sent the exploration ship 'Porthitis' to start explorations at the coast of northeastern Cyprus, violating its sovereign rights.

In 2019, ExxonMobil announced the existence of 5-8 tcf gas fields on block 10 ('Glaukos'). The announcement resulted in the dispatch of a second Turkish ship 'Yavouz' off Cyprus. This issue has led to the imposition of sanctions by the European Council (2019), including the suspension of the EU-Turkey dialogue and the reduction of pre-accession assistance to Turkey.

Efforts continue in 2020 & 2021 by the Government of Cyprus, to ensure the energy independence of country as much as the contribution to the EU energy security. The transformation of Cyprus into a regional energy hub and the strengthening of the geopolitical role of Cyprus. Due to the Covid-19, the progress in 2020 was extremely limited.



Source: Cyprus - Ministry of energy, Commerce and Industry

Exploration Licenses:

Block 2 – Granted in January 2013

- ENI Cyprus Limited (60%) - «Operator »
- KOGAS Cyprus Limited (20%)
- TOTAL E&P Cyprus BV (20%)

Block 3 – Granted in January 2013

- ENI Cyprus Limited (50%) - «Operator »
- KOGAS Cyprus Limited (20%)

- TOTAL E&P Cyprus BV (30%)

Block 6 – Granted in April 2017

- ENI Cyprus Limited (50%) - «Operator »
- TOTAL E&P Cyprus BV (50%)

Block 7 – Granted in September 2019

- TOTAL E&P Cyprus BV (50%) - «Operator»
- ENI Cyprus Limited (50%)

Block 8 – Granted in April 2017

- ENI Cyprus Limited (60%) - «Operator»
- TOTAL E&P Cyprus BV (40%)

Block 9 – Granted in January 2013

- ENI Cyprus Limited (60%) - «Operator »
- KOGAS Cyprus Limited (20%)
- TOTAL E&P Cyprus BV (20%)

Block 10 – Granted in April 2017

- ExxonMobil Exploration and Production Cyprus (Offshore) Limited (60%) - «Operator »
- Qatar Petroleum International Upstream LLC (40%)

Block 11 – Granted in February 2013

- TOTAL E&P Cyprus BV (50%) - «Operator»

- ENI Cyprus Limited (50%)

Block 12 – Granted in November 2019

- Noble Energy International Ltd (35%) - «Operator »
- Delek Drilling Limited Partnership (30%)
- BG Cyprus Limited (35%)

Source: Cyprus - Ministry of commerce and industry

5.4 Vasilikos LNG Terminal

According to the Ministry of commerce and industry (2019), the Vasilikos area was selected for the development of the project as it is in an Industrial Zone, it provides sufficient space for the development of various liquefaction plants ("LNG trains"), it provides a protected marine environment for the LNG Plant marine facilities, and it has good access to the existing road network. On July 9th, 2020, a foundation laying ceremony of the LNG installations in Vasilikos took place. The project will be constructed by China Petroleum Pipeline Engineering, a subsidiary of China National Petroleum Corporation (CNPC), and Greece's METRON S.A. The total cost is estimated to be around €289 million. The European Investment Bank has approved €150 million for funding this project. Another €43 million were funded by Cyprus Electric Company as part of an equity participation scheme, for which it received a 30% stake in the company. The LNG terminal is expected to be ready in 2023. If the decision of the government to proceed with the terminal is the right choice, it will be analyzed on Chapters 5 and 6.

5.5 Interview 1 (Charalambos Ellinas)

In September 2019, an interview was conducted with the international expert and consultant for hydrocarbon issues - former executive president of the State Hydrocarbon Company of Cyprus - Charalambos Ellinas (Ellinas, 2019). This interview will provide a lot of information regarding the quantities of natural gas in Cyprus, the block distribution and it will also provide a realistic analysis of the prospects of the gas market, and what strategy should Cyprus follow to get the maximum benefits out of these deals. According to Mr. Ellinas (2019), "the Eastern Mediterranean region has proven reserves of around 4,000 bcm. This means that about 2% of world reserves, and another 3,000-8,000 bcm can be discovered in the region."

Asked to analyze the prospects that for the natural gas in Cyprus, Mr. Ellinas stated that Cyprus faces several problems. To exploit block 12, a confirmatory drilling must be done, so that the exact amount that exists in the deposit in order to calculate costs and prices. Next, the infrastructure must be planned. Funding for the project must be found, and then the final investment decision must be made. This process will take another three years from today. Therefore, a possible decision for the export of Cypriot gas after three years and exports in 2025 at the earliest. The problem, however, is the price, which cannot compete with the prices that will be bought in the next decade in Europe. Even if Cyprus manages to find European or more likely Asian markets for the Cypriot natural gas that will be liquefied in Egypt, the profits will be meager. The minister in charge spoke of $9.5 billion. Mr. Ellinas believes that with the prices expected in the world markets after 2025, it is impossible to come up with such numbers.

Mr. Ellinas' thoughts about the Vasilikos LNG terminal are not optimistic. ExxonMobil is interested in the idea of creating the terminal in Cyprus if the necessary quantities of natural gas exist. For such a project to be economically viable, at least three liquefaction trains must be built, with a capacity of 15 million tons of gas per year, in order to significantly reduce the cost per unit.

Then there is a possible exportation problem. Today, Europe cannot be an affordable market for Cyprus. Cyprus can sell in Asia, where prices are expected to reach $7 to $7.50 by the middle of next decade, from $ 5-6 today. In order for such a huge project to take place in Vasilikos, the three companies operating in the Cypriot EEZ, ExxonMobil, Total and ENI, will have to work together in a consortium. In 2012 and 2013, when Cyprus started negotiations with Noble and Delek, the idea was for both Cypriot and Israeli gas to end up at the Vasilikos terminal. The idea of such a terminal first appeared by Delek in 2010, after the discovery of Leviathan. Negotiations were interrupted and the opportunity was lost. Today there is another opportunity, but companies will have to drop prices in Israel well below $4.50 on the platform. When Israeli gas reaches the country's internal market, the price exceeds $6 / MMBtu.

Regarding the drilling process, Mr. Ellinas described the advantages and disadvantages of the current situation. For the next two years, 2020-2021, up to nine drillings have been announced. Some of them will happen someday. He believes that these drilling activities will be postponed due to the intervention of Turkey. The process is delayed, but the companies want the drilling to proceed, especially the confirmatory ones. The positive side is that several of these wells are in areas and parts of the Cypriot EEZ, which are not claimed by Turkey or the Turkish Cypriots.

Mr. Ellinas said that the idea of Europe becoming independent from Russia's gas is just a myth. In 2018, the Russian Gazprom agreed with the European Commission to comply with all European laws and to export natural gas to Europe in accordance with European directives / regulations. The situation has now normalized, and Russia's gas is so cheap that no one can compete with it. Gazprom can sell gas in Europe for $4 and make a profit. And Novatek, which has Arctic Circulation liquefaction terminals, can export LNG to Europe for $3.50 a unit and make a profit.

In Chapter 2, it was explained why Turkey was one of the countries selected to be examined. At this point, Mr. Ellinas' opinion will be presented and some data that were previously presented

in Chapter 2 will also be analyzed in relation with Cyprus. According to Mr. Ellinas, Cyprus should consider exporting gas to Turkey. The main reason why he believes this is because Russia is currently selling gas to Turkey at a price of about $5 and in the middle of the next decade, it can go up to $6. Thus, if Cyprus manages to export to Turkey at competitive prices, there would be chances of quick and profitable exploitation of Cypriot gas. Turkey is trying to find alternative sources. For example, when the incident with the downing of the Russian fighter jet took place, Ankara was very worried about the possibility of Russia stopping the export of natural gas to Turkey, and this would be a bit hit for Turkey because 55% of Turkey's gas comes from Russia. This means, they want to have alternative sources to decrease the level of dependance on Russia's gas. About 1/4 of the natural gas used by Turkey comes from LNG imports from various countries such as Nigeria, Algeria, USA, Qatar, Egypt, Norway, etc. There is a possibility for Cypriot gas, but Cyprus must first get to the point where can export.

The answer Mr. Ellinas provided when he was asked about what he thinks will be more beneficial, a terminal at Vasiliko or a pipeline from Cyprus to Turkey he said that the terminal at Vasiliko will cost about $15 billion, and its profits will be low. A pipeline to Turkey will cost about $3 billion. If Turkey is willing to give 5+ dollars / MMBtu, then this scenario is financially viable, something that oil companies will also be interested in. However, there must first be a solution of Cyprus-Turkey relations. In June 2019, Turkish Foreign Minister Mevlut Cavusoglu said in interviews that the Greek Cypriots must learn to share natural gas and if they learn to share it, we will find a solution to the Cyprus problem. So, there are prospects for the Cypriot gas, but the Cyprus conflict issue must be resolved first.

At this section, Mr. Ellinas will answer some questions that were raised previously in this dissertation regarding natural gas and EU environmental regulations. Mr. Ellinas said that Cyprus must move forward soon with its energy plans. Delays may mean less profit. Huge changes are taking place in Europe. The new EU President, Ursula von der Leyen, to get the approval of the

European Parliament, made important promises that have to do with the environment. She promised that by 2050, Europe will pass legislation to achieve carbon neutrality. By 2030, carbon dioxide will be reduced by 50-55%. She also promised that in the first 100 days of her presidency, a new "European Green Deal" plan would be prepared, which would present Europe's new policy on environmental issues. This means that the use of natural gas in Europe will be much more difficult form 2025 and later. In order to be able to use it after 2030, it will have to be cheap and green.

5.6 Interview 2 (Dimitris Fessas)

In the previous interview, topics like Vasilikos LNG terminal, Turkey's role in exploitations of hydrocarbons were analyzed by Mr. Ellinas. At the second interview conducted on February 2019 by CNN Greece, Mr. Fessas analyzes the steps the Republic of Cyprus took regarding hydrocarbons' exploitation, the difficulties on this process, the significance of Zohr discovery in Egypt, the negotiations with the partners, the prospects, and he also gives a timetable for Cyprus first gas production and the conditions for sustainability of EastMed. Dimitris Fessas is the acting General Manager of Cyprus Hydrocarbons Company (CHC) (Fessas, 2019).

Mr. Fessas believes that attracting the oil and gas industry giants in Cyprus is an important sign of the hydrocarbon prospect in the Republic of Cyprus. The fact that these companies came to Cyprus is a vote of confidence for the prospects for the development of the hydrocarbons sector in the Republic of Cyprus. It is worth noting the catalytic role of the actions taken by the government to create a stable investment environment in this area, such as the delimitation of the Cyprus EEZ and the development of best relations with neighboring countries Egypt, Israel, and Lebanon.

During this interview, Mr. Fessas was asked “What will be the next stage for hydrocarbons exploitation in Cyprus?”. He answered that there are two elements to how the subject is viewed. It is a matter of commercially exploiting what Cyprus has so far and there is the research phase of trying to maximize the findings, which is an ongoing review process. As for the commercial exploitation phase, The Block 12 deposit discovered in 2011, was characterized as a commercially exploitable discovery in 2015 and since then work is being done to commercialize it. The plan for this block is to export it to Egypt in its existing liquefied natural gas facilities and subsequently sell it to international gas markets. This option concurs with the EU's energy policy to diversify gas supply sources as long as the Cypriot gas can supply European markets. During 2015-2017, intensive negotiations took place with potential buyers of natural gas in Egypt, including the companies involved in the country's liquefaction terminals. At the end of 2017, gas sales negotiations reached a mature stage, both in terms of sales volume and prices.

Recently, given the low price of natural gas in the international market, the licensee of Block 12 has expressed some concerns about the financial feasibility of the project. This is something that the Cypriot Government and the Hydrocarbon Company are not fully aligned with, but it is up to the international oil companies to determine their investment criteria. In order to resolve this issue, many discussions were held in 2018. It worth mentioning that the contract for Block 12 was the first signed in 2008, during the first licensing round. The second and third rounds of contracts are more mature. On the financial side, a formula will be added to the contracts of the second and third rounds of negotiations, which will deal with possible scenarios of low gas prices that affects licensees and will further provide Cyprus with higher profits in case of high gas prices in international markets. As for the hydrocarbon exports, the discovery of the Zhor deposit in Egypt opened a new geologic model in the Eastern Mediterranean, which was confirmed by the discovery of the Cypriot Kalypso deposit. Zohr is only 6 kilometers from the EEZ of Cyprus. This discovery is based on a carbon platform that is something new in our region. When the discovery of Zhor was made known, geoscientists evaluated the prospect of such structures within Cyprus

EEZ, so it was found that there was a prospect. The works that have been done has led the government to move on to the third licensing round, which granted research permits for three more blocks, block 6, 8 and 10.

As for the exploitation, there are negotiations for Block 12, which includes the development plan, and then there will be the exploitation contracts. At the same time, a preparation for the final investment decisions will be done, which will take some time and once this is done, it will take about three years for the first gas production. Other issues related to the Aphrodite deposit are the exports to Egypt. The two governments and the trading partners signed an interstate agreement for the pipeline that will set the commercial structure of the pipeline. After the scheduled research activities in the 6,7 and 10 Blocks, a better picture of the gas volumes in the area will be drawn and then a determination can be done regarding what the commercial exploitation options might be. For every new hydrocarbon breakthrough, a new evaluation about every possible option available depending on hydrocarbon volumes, markets and development costs must be performed.

One of the much-discussed possibilities is the EastMed pipeline. An approach is being seen to this issue by the governments of the Eastern Mediterranean region as well as by the EU in evaluating this option, which is aligned with the EU policy on diversifying energy sources. It may be in the region's interest as an energy export hub. It is a project of mutual interest in the EU. From a technical point of view, it is considered feasible, commercially dependent on where the European market will move in 5 to 6 years from now, but It also depends on the hydrocarbon volumes that will be discovered the following years. For years, there was a question about the establishment of an LNG station in Cyprus. The liquefaction terminal was a viable option in 2011. Now, international markets have changed and the scope of the discoveries in the Cyprus EEZ cannot support its creation. Consequently, the terminal continues to be a national strategy but with today's data this option has come off the table. But if significant hydrocarbon breakthroughs

are discovered during the next years, this option may come to the table again. Another option for exploiting new deposits is to export them to Egypt if they can be absorbed.

When Mr. Fessas was asked about his opinion about the EU's supply of gas from Russia, and if this could possibly make EastMed uncompetitive. He said it will take some time for anyone to confirm whether the necessary quantities exist to make this project viable. It will take about five to six years to have significant discoveries. So, the question is where the European energy market will be in five to six years from today. Another part of the EU's energy policy is the attempt to diversify sources of energy supply. In conclusion, the EastMed pipeline is not a project the country can invest in today; however, it can be considered as a possible future option for gas exploration.

5.7 Interview Analysis & Data Analysis

Both Mr. Ellinas and Mr. Fessas expressed their opinions on several topics around the exploitation of hydrocarbons in Cyprus. One of the much discussed and most decisive topics that both expressed their thoughts is if Cyprus should proceed with the construction of Vasilikos LNG terminal or not. Both experts agree that is early to decide if the terminal is a sustainable solution or not, and the decision depends on the quantities of hydrocarbons that are going to be discovered after the confirmatory research is completed. Mr. Ellinas believes that the option to export to Turkey might be more advantageous for Cyprus than building an LNG terminal because not only it will cost less money to build a pipeline to connect Cyprus with Turkey, but it can also be sold in higher prices in Asia than in Europe. Mr. Fessas on the other hand expressed the opinion of exporting to Egypt if Egypt can absorb all the hydrocarbons that will be discovered. He believes that the LNG Terminal should still be considered as a national strategy if significant amounts of hydrocarbons are discovered in the next years. Mr. Fessas also gave a similar answer about the EastMed pipeline. He said there is no definitive answer right now and it will take some

years and more research to confirm if the necessary quantities exist to make this option viable and he also said the question if the gas supply from Russia can make EastMed uncompetitive cannot be answered now. In contrast, Mr. Ellinas expressed his opinion about this issue right away. He said there is no way anyone can compete Russia's prices and the idea of Europe getting its independence from Russia's gas is just a myth since Russia can sell the gas way cheaper than all the other alternatives.

Mr. Ellinas believes that Cyprus should move forward with the energy plans as soon as possible, because the longer the country waits, the less profit will make. The reason he believes this, is because if Cyprus is trying to have as main export resource the EU, and a reduction of the demand for natural gas was already noticed and this is mainly because EU is now trying to insert to a new era of lower carbon emissions, by applying the European Green Deal. As previously mentioned, Mr. Ellinas said that exporting to Turkey might be a good option for Cyprus to increase the profit and it might be a good opportunity to resolve the conflict between Cyprus and Turkey. But Cyprus government must be overly cautious about this choice. Like it was mentioned in the introduction; the biggest obstacle for Cyprus at this moment is the continued acts of provocations from Turkey. The relationship between Turkey and Cyprus over natural gas discoveries needs to be handled in a smart way and Cyprus government must be overly cautious and act proactively on Turkey's provocations. Mr. Ellinas and Mr. Fessas agree that it is early to decide now if Cyprus should proceed with the LNG terminal or not. These interviews were conducted in 2019 though. In this section of the dissertation, data that will later help determine if the decision of Cyprus government to build the LNG terminal in Vasilikos is the right choice or if the county should have proceeded with alternative options.

Based on the data collected up to April 2021, the estimation for Block 12 - Aphrodite gas field which was discovered offshore Cyprus in 2011, has a mean gross amount of gas of about 5.5 tcf. In 2015, Block 12 was declared as commercial. The results of exploration wells drilled in Block 9

of Onasagoras 1 and Amathusa 1 were unsuccessful. In early 2018, ENI has made a gas discovery in Block 6 – Calypso. "The well, which was drilled in 2,074 meters of water depth reaching a final total depth of 3,827 meters, encountered an extended gas column in rocks of Miocene and Cretaceous age. The Cretaceous sequence has excellent reservoir characteristics. Calypso 1 is a promising gas discovery and confirms the extension of the "Zohr like" play in the Cyprus EEZ" (Journal, 2018). No official announcement was made by ENI as to the estimated quantity of natural gas, but based on other sources, it is estimated to be around 6.5 tcf. "Block 10 – Glaucus-1, encountered a gas-bearing reservoir of approximately 133 meters. The well was safely drilled to 4,200 meters depth in 2,063 meters of water. Based on the preliminary interpretation of the well data, the discovery could represent an in-place natural gas resource of approximately 5 to 8 tcf. Further analysis in the coming months will be required to better determine the resource potential." (Journal, 2019) These are the quantities that are estimated so far to exist in Cypriot EEZ. Next factor to be analyzed is the price of natural gas in Europe.

The pandemic due to Covid 19 hit oil and gas industry more than any other industry. This fact obviously had a big impact in Cyprus. Some examples that show the impact are illustrated in Dionisiou's article (2020). Noble Energy has raised the issue of suspending the development of the deposit, even though in November 2019 a final development plan with the Cypriot government was signed. At the same time, the other companies operating in Cyprus EEZ, such as ENI-TOTAL-EXXON, have suspended their programs in the first phase for 2021, and it is possible that they will request new extensions in the future. Aside from Noble announcing at the end of the first quarter of 2020 a net loss of $4 billion and a 53% cut in spending, the results of the first quarter of 2020 of ExxonMobil were very disappointing, reflecting the crisis facing the global hydrocarbon industry. Exxon lost $610 million for the first time in 32 years. Something that forced the company to announce in April cuts of 30% in its expenses for 2020 and to accelerate its plans for sales. Responding to the disappointing results of the first quarter and the crisis affecting the oil and gas industry, Shell, Total, ENI and Noble also announced significant spending cuts, ranging

between 20%-50% in 2020, which will continue in 2021. The companies proceed with restructuring and sale of non-core assets, taking measures to safeguard their profits. To move towards a sustainability plan, these companies have also launched plans for a carbon-free future. With the uncertainty about the future of oil and gas demand becoming long-term, and the resilience of industry no longer guaranteed, they are developing green energy. ENI is one of the last to join in this direction, strengthening its businesses in renewable energy at the expense of oil. Besides these facts, the Minister of Energy George Lakkotrypis in his statements to "Politis" acknowledges the economic problems from the decrease in prices internationally from the crisis caused by the pandemic, but he is optimistic that this will eventually change. He said "I believe that natural gas will remain for many more years as a fuel - bridge. "We are moving from oil to clean energy, but gas will still be in the spotlight because of its low emissions." Mr. Lakkotrypis is optimistic about gas prices, which are currently kept extremely low due to its interconnection with Brent prices. As he points out, prices tend to disconnect in favor of the gas price. Natural gas is already disconnected from Brent prices and he also said "the disconnection of LNG prices from oil prices has already begun. The trend that prevails internationally is that the prices are determined more by geopolitical criteria, therefore the prices of gas should not be related to this logic." (Lakkotrypis, 2020)

In July 2020, the European Union leaders made an agreement to fund 750 billion euros on the Next Generation EU (NGEU) project. This is the largest stimulus package ever financed in Europe and the purpose of this agreement is mainly to help the EU members to address the economic and social impact of the Covid-19 pandemic, thus the largest percentage of this fund (€672.5 billion) will be invested in the Recovery and Resilience Facility (RRF). In order to receive support from the RRF, the EU member were asked to set out a coherent package of projects, reforms and investments in six policy areas:

- the green transition

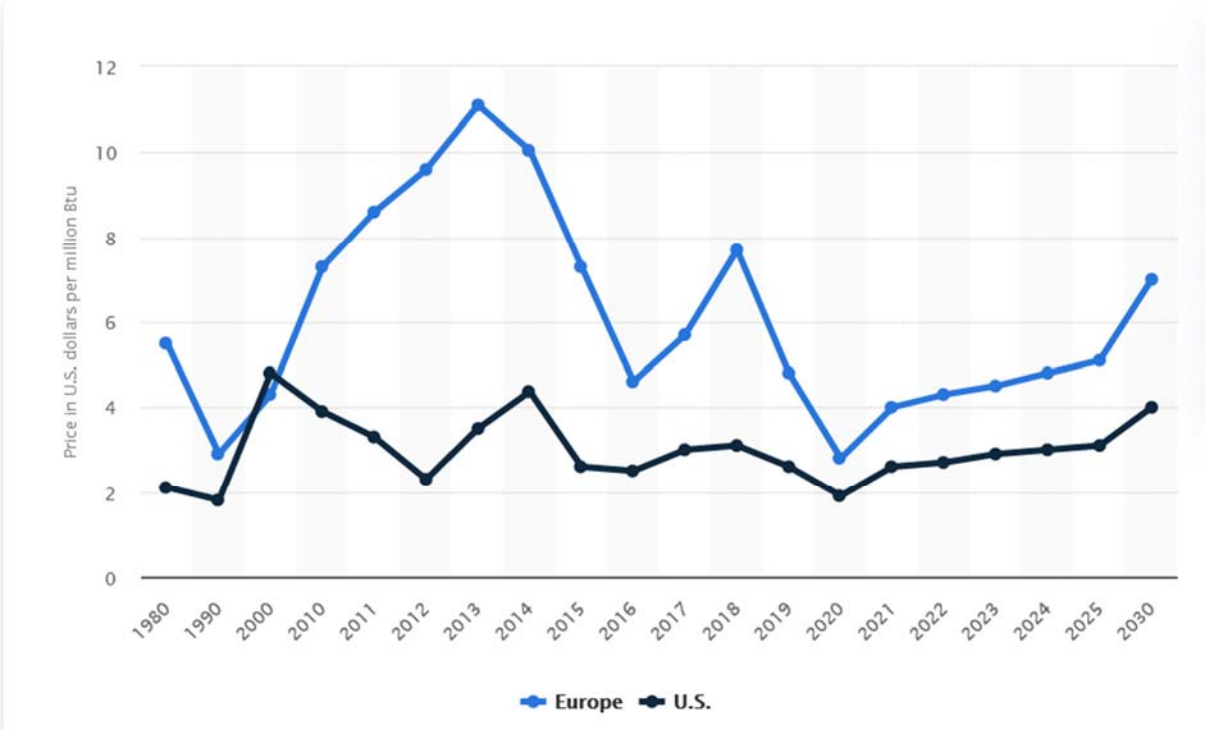
- digital transformation
- smart, sustainable and inclusive growth and jobs
- social and territorial cohesion
- health and resilience
- policies for the next generation, including education and skills

As of the fight of the climate change 30% of whole funding, will be invested, and this makes it the highest share ever of the European budget. (Council of EU, 2021). Therefore, the green transition along with the European "Green Deal" where the EU is trying to achieve zero carbon emissions until 2050, is estimated to make the demand on natural gas to drop. Despite its low carbon footprint, analyst estimate that by 2050 the demand of natural gas might drop by 75-85%, and the demand of cheaper renewables energies will be constantly increasing. The European commission is proposing rules to restrict funding for natural gas projects and instead direct these investments into low-carbon technologies to meet the climate goals that were set. The European Investment Bank is also committed to stop support of oil and gas projects after 2021, with the European Bank of Reconstruction and Development going in the same direction. All these EU regulations in addition with the hit of the pandemic on the oil and gas sector, makes Cyprus plan to have the EU as the main export resource even more difficult.

The hit of the pandemic on oil and gas industry can be also seen in the chart below (Chart 1). The chart illustrates the natural gas commodity prices (prices in constant U.S. dollars) in the United States and Europe from 1980 to 2030. The figures from 2020 to 2030 are projections and the figures from 1980 to 2018 are already accurate. As it can be seen from the chart, in 2020 the natural gas hit a low-price record at $2.8 per MMBtu. The next lowest price was way back in 1980 at $2.9 per MMBtu. The positive side of this projection for Cyprus is that the prices in 2021 are getting slightly higher ($4/MMBtu) than in 2020 and they are estimated to have a rising trend in

the next years. Until 2025/2030 where Cyprus is expected to start exporting natural gas, the prices are expected to be between $5-7 per MMBtu.

Chart 1: Natural gas commodity prices (U.S. dollars) in the United States and Europe from 1980 to 2030

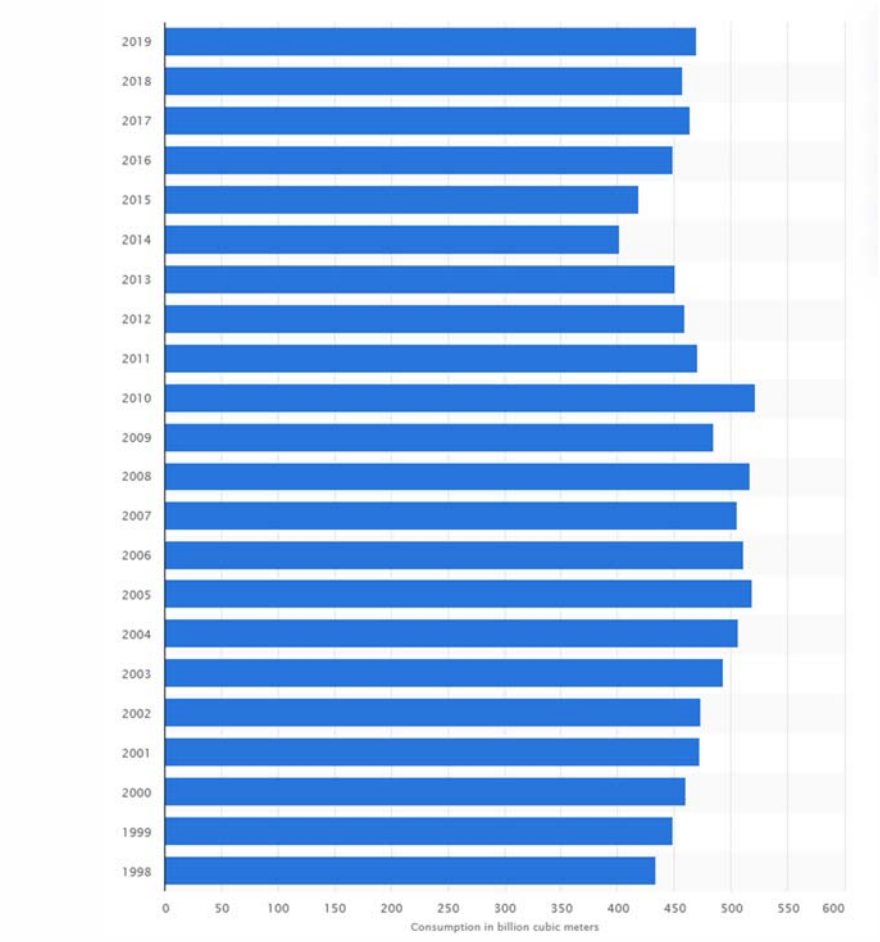


Source: Statista.com

As of the consumption of natural gas in the EU (Chart 2), unfortunately a chart with projections up to 2030 was not found but the consumption in the EU from 1998 until 2019 is presented. In 2019, the gross domestic consumption of natural gas in the EU increased by 4.2 % in comparison with 2018. The highest pick for natural gas consumption in the EU, was in 2010 with consumption 521.3 bcm. After 2010, the consumption was decreased and the average consumption between the years 2011 and 2019 was 449 bcm. Based on the calculations of the consumption for the years 2011-2019, the standard deviation is equal to 24.02 bcm. This event can be interpreted

that there are not huge fluctuations on the natural consumption in the last 9 years, and it reveals a stability on the natural gas consumption inside the EU the last decade. If the consumption remains relatively stable for the next decades as well, these are positive news for Cyprus because the option of exporting to the EU is one of the most favorable. Not necessarily for the economic part but also for geopolitical reasons.

Chart 2: Natural gas consumption in the European Union from 1998 to 2019 (in bcm)

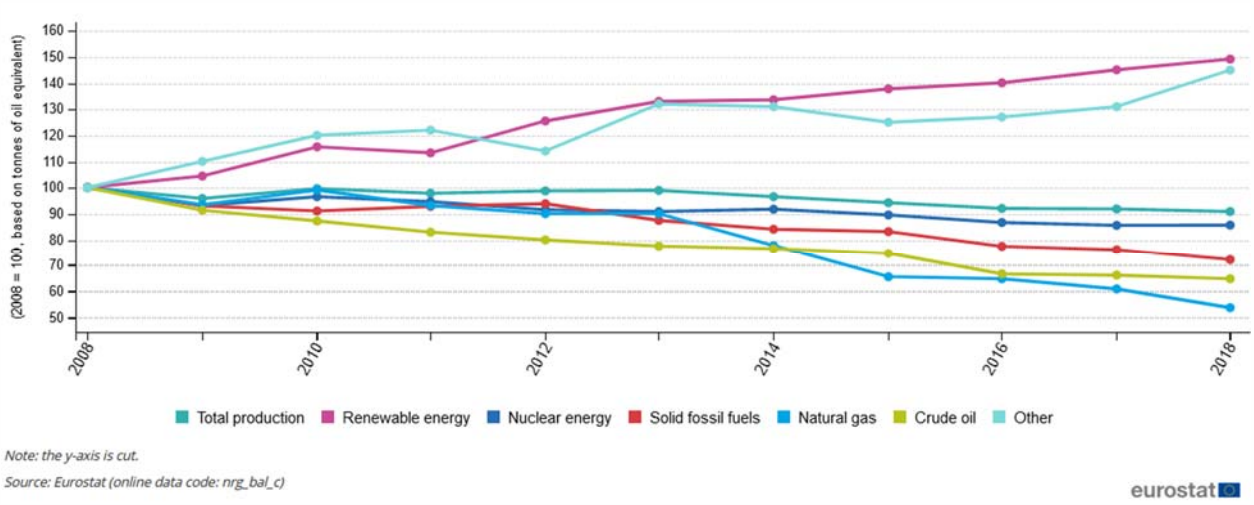


Source: Statista.com

From the perspective of European natural gas production (Figure 3), it is obvious that the European Union's natural gas production has a sharp decline the last 10 years, while the

production of renewable energy has been steadily increasing. “The production of natural gas in the Netherlands, the main EU producer of natural gas, fell by -13.5%. Significant declines were also observed in Denmark (-25.4%), Ireland (-22.2%), Croatia (-16.3%), Italy (-11.0%), Hungary (-9.2%) and Austria (-9.2%). In contrast, there was an increase of 0.5 % in natural gas production in Poland. With a natural gas production of 1122 thousand terajoules in 2019, the Netherlands was the first producer of natural gas in the EU, followed by Romania, whose primary production was of 386 thousand terajoules and Germany, whose primary production was of 202 thousand terajoules.” (Eurostat, 2020).

Chart 3: Production of primary energy by fuel type - 2008-2018

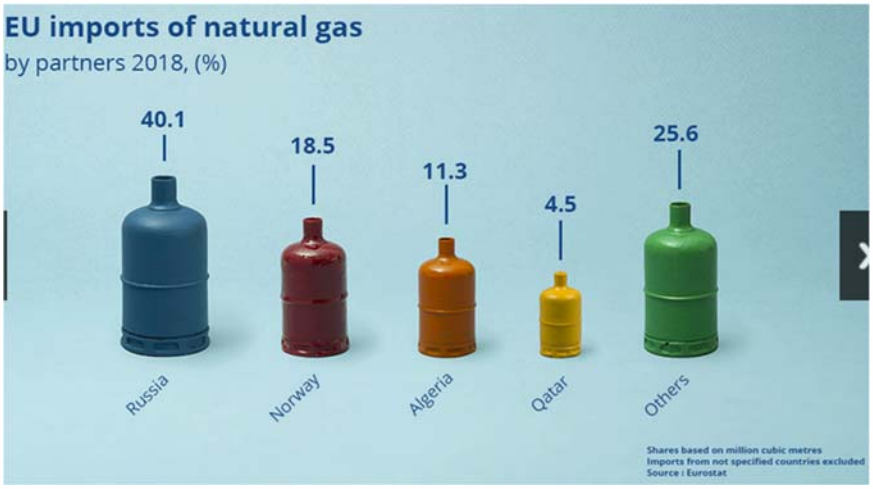


Source: Eurostat

As illustrated on Chart 2, natural gas consumption in the European Union has been relatively stable in recent years, but natural gas production has been declining year by year. As a result, the EU must import more natural gas from external sources every year. It is estimated that in 2018, 58% of the EU’s gross available energy came from imported sources. As depicted in (Chart 4), 40.1% of natural gas was imported from Russia in 2018. This makes Russia the most important import resource of natural gas in the EU. In addition, the next three countries where the EU

imports natural gas (Norway, Algeria, and Qatar) are not EU members. (Norway has been only a member of the European Economic Area (EEA) since 1994.)

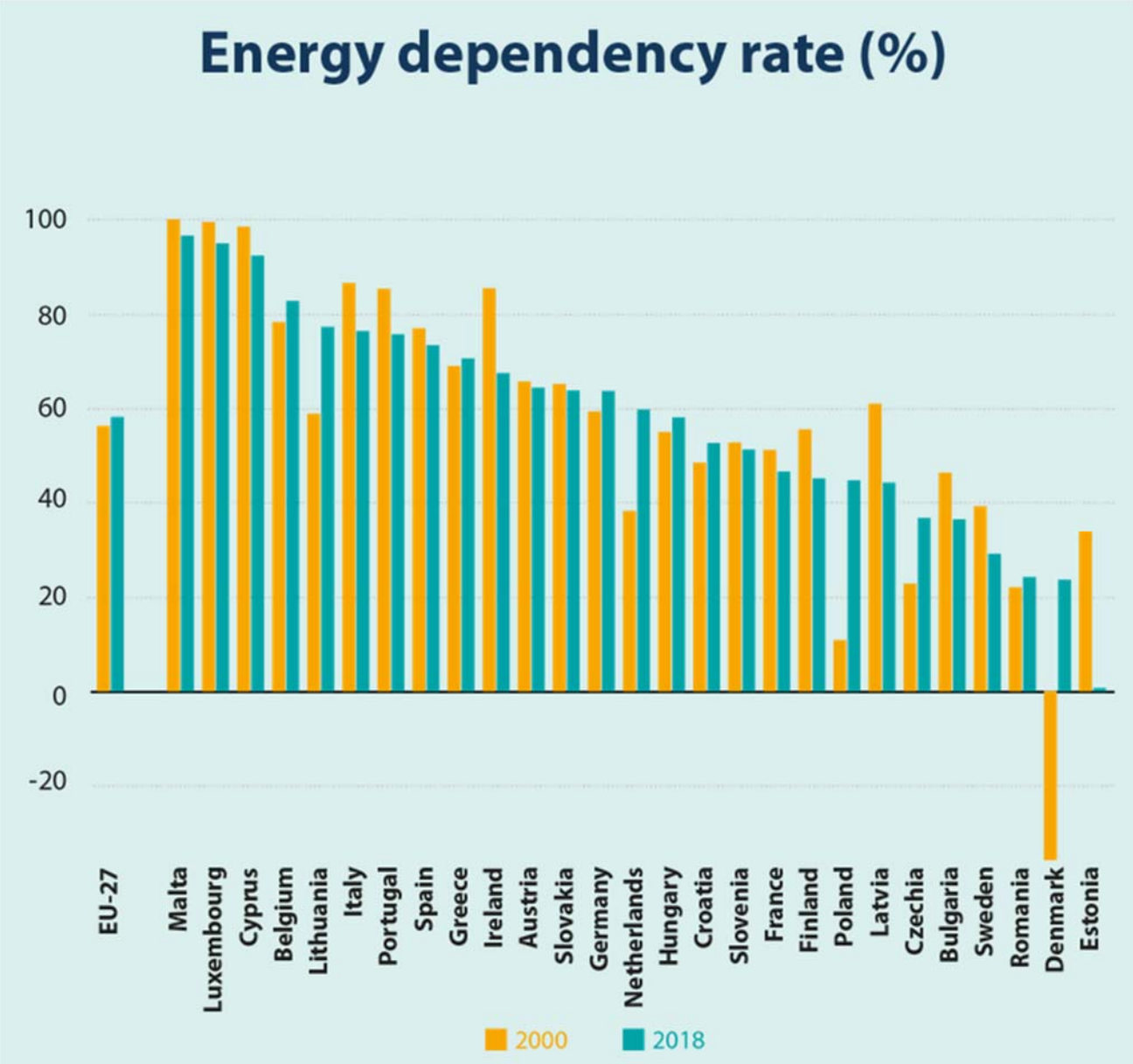
Chart 4: EU Imports of natural gas



Source: Eurostat

Another interesting graph (Chart 5) is the energy dependence of each country in the European Union. As it is indicated below, Cyprus has the 3rd highest dependency in Europe with an approximate dependency of 99% in 2000 and 92% in 2018. This fact reveals the immediate need of energy independence for Cyprus. Energy independence means reducing as much as possible the dependence on other countries for oil and fuel. In this way, not only would the country's economic stability and growth can be increased, but it can also provide extra security as there is no need to rely on other countries and political relations with those countries for important energy related issues.

Chart 5: Energy dependency rate per Country



Source: Eurostat

Chapter 6
Results

Based on the quantities that have been discovered so far inside the country's EEZ, (as a reminder these are not yet confirmed but these are the estimated values per block) the average total quantity from blocks 6, 10 and 12 is 18,5 tcf (18,500,000,000 MMBtu). Based on these quantities, an analysis will follow with the intention of drawing results about the viability of the LNG terminal project. This project to be sustainable it needs "about 12.5 trillion cubic feet of natural gas discoveries and in addition increased funds for the construction of infrastructure and pipelines are needed" (Adamou, 2021). In 2030, Cyprus is estimated to be ready to start exporting natural gas. According to (Chart 1) in 2030, the price of US dollars per MMBtu in Europe is estimated to be $7. Thus, 18,500,000,000 * $7 it is translated to the astronomical amount of $129,500,000,000. Of course, this will not be the net profit Cyprus will have since there are many other factors to be considered. For example, "the proportional distribution of revenues between the country and oil companies is usually set at around 60% for the country and 40% for the exploring companies" (Assiotis, 2019).

Another factor that needs to be taken into consideration, is the cost to build the LNG terminal. The cost of the project is estimated at 289 million euros. The other choices are either to connect Cyprus with Egypt's LNG terminals or like Mr. Ellinas proposed to build a pipeline to connect Cyprus with Turkey with an approximate total cost of about $3 billion dollars. By following the solution of building pipelines to Egypt or Turkey or both if the future discoveries allow, the cost will be less but other vital benefits for the country having its own terminal will be lost. These benefits will be reviewed later in this chapter. As of the profit, for example at Block 6 the profit

is estimated to be in total 35 billion dollars. With the LNG terminal, Cyprus might get only the 1/3 of this amount as a net profit but if Cyprus follows one of the other two solutions, the profit might be higher.

But the benefits of the LNG terminal should not be concentrated only on how to maximize the economic profit, but they should also be focused on the strategic importance. As it was depicted in Chapter 2 where studies for natural gas in other countries were reviewed, it can be concluded that the geopolitical value of natural gas is equally significant as the economic value. There are many strategic benefits Cyprus can get out of the LNG terminal. According to Poullados (2017), some of them are, with the construction of a liquefaction station, Cyprus will upgrade its geopolitical value because from a simple energy passage the island will be transformed into an energy hub. Cooperation with neighboring friendly countries will enhance the security of the country. Moreover, the fact that Cyprus is a member of the EU will allow the country to multiply its value in terms of the Union's energy security, making it even more important to find a beneficial solution to the Cyprus problem. Analysts estimate that if the final decision is to build a terminal, this decision will create about 100,000 jobs. In the Mediterranean so far only Algeria, Egypt and Libya are the countries that have liquefaction facilities and can export, while only 6 countries (Spain, France, Italy, Greece, Turkey and Portugal) can only import liquefied natural gas. It is important to mention here that several Mediterranean countries such as Morocco, Jordan, Lebanon, Bosnia, Slovenia, depend on a single supplier and Cyprus can play a catalytic role towards their independence. It should also be borne in mind that in the Eastern Mediterranean, the EU does not have an LNG station and Cyprus is the ideal player close to strategic energy reserves. The decision of the EU to fund via the European Investment Bank (EIB) the amount of €150 million (approximately half of the total cost), is another proof that the European Union is in need of Cyprus's natural gas. As the strategic analyst Lygeros (2017) notes, "Cyprus' relations with Lebanon, Israel and Egypt are particularly good and this has been proven by the demarcation agreements. Consequently, an LNG station in Cyprus adds a great value

because it turns it into an energy hub. Thus, transporting gas to an existing LNG station through Egypt is not a good choice. It tries to minimize the cost of the investment, but in the long run it creates a dependency that we do not need." What Mr. Lygeros said about the energy dependency of the country, is also proven on (Chart 5) which illustrated that Cyprus has a remarkably high dependency on energy sources (92% in 2018) and to gain independence on energy sources adds a lot of benefits in the geopolitical stage.

Both variables set by Mr. Adamou at the beginning of this chapter are satisfied. The estimated discoveries are 18,5 tcf and the increased funding needed for the construction of the terminal came from the EIB. Therefore, based on the above analysis and taking into consideration the high strategic importance of this project, the decision of Government of Cyprus to proceed with the LNG terminal was the right one.

Chapter 7
Conclusion

The purpose of this study was to analyze the economic situation of Cyprus, and especially the impact of natural gas on the economy. The key questions that were set at the introduction chapter and were answered later in this dissertation were, how natural gas will affect the economy of the country and if the LNG terminal in Vasilikos will be a good solution for Cyprus; or if the country should proceed with alternative options. The answers to these questions are based on the known hydrocarbon discoveries until today. In this research it was also attempted to provide a lot of useful information to the reader regarding what the natural gas is, the environmental impact of natural gas, what is the type of Cyprus economy, all the phases the economy and the natural gas sector went through the years in the country and what is the economic status of Cyprus right now and in addition, what is the current status of oil and gas sector in the country. The reader after perusing this dissertation can form a full picture of this sector and its impact in Cyprus.

In Chapter 2, studies for the natural gas field in other countries were provided and specifically for the countries of Israel, Egypt, and Turkey. These countries were specifically selected because not only they are neighbor countries with Cyprus, but even more than that, these countries like it was depicted above, they are closely related (a good relationship between Cyprus, Israel and Egypt and a bad relationship between Cyprus and Turkey) with the hydrocarbon sector of Cyprus. These studies were mostly concentrated on the impact of natural gas in the economy of each country, but they were also emphasizing the geologic value of this sector in each country. This is not just a coincidence. The reason is because the energy field has a huge economic impact but

also an extremely high geopolitical value and this cannot be ignored. For example, as it was illustrated in Israel's study, the government decided to do not export to Turkey because of the sensitive diplomatic relation between the two countries. On the other hand, like it was mentioned in Chapter 5, Mr. Ellinas expressed the opinion that Cyprus should consider the option of exporting to Turkey and not to the EU, because not only the infrastructure will cost less to connect Cyprus with Turkey, but also it can be sold in higher prices in Asia than in Europe. In addition, based on the study for natural gas in Turkey it can be concluded that Turkey is trying to find additional resources to gain some independence from Russian natural gas. This event makes Mr. Ellinas' opinion a realistic one but what does not make it an ideal option is that Turkey has proven over and over through all these years cannot be a trusted associate. Mr. Ellinas also expressed the opinion that the hydrocarbons exploitation might also be an important opportunity to resolve the Cyprus conflict. In 2020 and 2021, several important events took place, like the pandemic due to Covid-19, the deal between Greece and Egypt regarding the determination of EEZ, in late 2019 Turkey and Libya signed a secret EEZ agreement/memorandum of understanding. Similarly, in 2020, Turkey dispatched research ships, followed by warships in the exclusive economic zones of Greece and Cyprus approaching the Greek Islands, surpassing all previous provocations, and trampling on all previous agreements and laws. All the above created new elements in the eastern Mediterranean area.

Regarding the new geopolitical balances that were formed in 2020-2021. Additional problems, which focus on Turkey's moves in the Cypriot EEZ and of course have to do with the solution or not of the Cyprus problem re-appeared. The exploration program of Cyprus is affected by the non-solution (proof of the incident in Block 3 where the drilling was canceled by Turkey, as well as the illegal drilling that it carries out in pieces which was already licensed to Total and ENI). In short, postponing the development of natural gas deposits for a long time, and due to political complications, is not in Cyprus' benefit. "This means that the country will be economically locked in LNG imports for a longer time and will pay for it through high electricity prices, at a time when

its own natural gas remains unexploited buried deep in the Eastern Mediterranean. At the same time, the construction of EastMed, after Italy's refusal to contract, highlights the project in another utopia, which leaves Cyprus with just a couple of realistic choices. Either it will operate with its own reserves and Israeli synergies from Leviathan to build its own terminal at Vasilikos and obtain a lot of strategic and economic advantages, or it will move to build a pipeline to Turkey, which is in urgent need of gas" (Ellinas, 2020).

In conclusion, the natural gas can indeed be a blessing and a curse for Cyprus. The economic crisis, the big hit of the pandemic to the oil and gas sector, the historically low prices in the gas market and the political problems due to the no-end discussions between Cyprus and Turkey that hinder the development of the drilling problem of Cyprus, make the effort of Cyprus to become an exporter of natural gas extremely hard. The non-solution of the Cyprus conflict and the unacceptable actions of Turkey through these years cannot rule out a severe episode in Cyprus region and this creates many additional delays on the project. Unfortunately, valuable time has been already lost, but there are still prospects, as Cyprus' natural gas can be for several more years the energy bridge in Europe until the transition to clean energy is done. Of course, to achieve such a thing, new strategies and energy policies must be invented by the Cypriot government based on realistic political and energy analysis considering always the economic and the strategic importance of the sector.

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