Development of Virtual Natural Gas Pipelines in Greece

by
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Ο Σταμάτης Διολέττας βεβαιώνω ότι το έργο που εκπονήθηκε και παρουσιάζεται στην υποβαλλόμενη διπλωματική εργασία είναι αποκλειστικά ατομικό δικό μου. Όποιες πληροφορίες και υλικό που περιέχονται έχουν αντληθεί από άλλες πηγές, έχουν καταλλήλως αναφερθεί στην παρούσα διπλωματική εργασία. Επιπλέον τελώ εν γνώσει ότι σε περίπτωση διαπίστωσης ότι δεν συντρέχουν όσα βεβαιώνονται από μέρους μου, μου αφαιρείται ανά πάσα στιγμή αμέσως ο τίτλος.

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Abstract

Natural gas transmission and distribution pipelines network does not cover all country's territory. There are significant geographic areas that have not access to it. Natural gas is an opportunity fuel i.e. cheap and clean which can help local economies to grow. Since the expansion of the network is not in the near future plans of the National Natural Gas Transmission System Operator, alternatives should be under consideration. "Virtual" pipelines could an economically and technically viable solution. Liquefied Natural Gas (LNG) could be transported from Revithousa LNG terminal to the Industrial Zones of Patras and Ioannina, westwards of the country. There, installed regasification plants will convert it into gaseous natural gas. A pipeline network will distribute it to consumers within the industrial area while remote costumers will be supplied with compressed natural gas (CNG). There is mature available technology so that "virtual" pipeline project should be able to operate soon after license acquisition.

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Abbreviations

BP	British Petroleum
DEPA	Public Gas Corporation
DESFA	Natural Gas Transmission System Operator
CHP	Combine Heat & Power
CNG	Compressed Natural Gas
EPA	Gas Supply Companies
ESCO	Energy Service Company
EU	European Union
GAV	Gross Added Value
GDP	Gross Domestic Product
IEA	International Energy Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
NNGTS	National Natural Gas Transmission System
OECD	Organisation of Economic Co-operation & Development
PPC	Public Power Corporation
RAE	Regulatory Authority of Energy
TAP	Trans-Adriatic Pipeline
VIPE	Industrial Zone
WAIP	Weighted Average Import Price
WB	World Bank

Introduction

Nowadays Greece is facing a severe economic recession. Greek economy has many deficiencies, but it mainly suffers from lack of competitiveness. According to the World Economic Forum (World Economic Forum, 2015) global competiveness report, Greece ranked 81st among 140 countries. It occupies, also, the last position in the advanced economies. There are many factors that contribute to the competitiveness, but in this case the focus should be on domestic competition. In Greece, many efforts have been made to increase the competition between companies of various sectors of its economy. As a result, many sectors ceased to be state monopolies, such as telecommunications and theoretically electric power production and retailing.

The energy market liberalisation in European Union was started in 1996 with the directives 96/92/EC for electricity (EC, 1996) and 98/03/EC (EC, 1998) for natural gas market respectively. These two were followed by the directives 2003/54/EC (EC, 2003) and 2003/55/EC (EC, 2003) for electricity and gas market respectively. Finally, EU issued the directives 2009/72/EC and 2009/73/EC for the common rules of electricity and gas market respectively. The last two directives substitute the former ones and create common rules for a European common energy market.

Greece started weak market reforms in 1999, but today has fully adopted the above-mentioned EU legislation. For that reason, Greek energy market can be considered as liberalised and open to competition. In following chapters, the Greek legislation and market status will be described and analysed.

Although national legislation created the rules for an open energy market, the last is far from being so. There is a pluralism of companies in electricity and gas market, but the incumbents dominate it, PPC in electricity and DEPA in gas market. Electricity production system covers all the country, there is not a single village or island without electricity supply. Gas transmission and distribution system, on the other hand, has been developed in North and East part of the country. There are plans for its extension, but even the most ambitious of them leave a great part of the country without gas distribution network. In the following chapters Greek natural gas transmission and distribution system will be presented.

Energy is the most important component, after workforce, for the economy. Cheap and clean energy, such as natural gas, is a substantial factor that increases the competitiveness of the companies. Additionally, it is important for the households, the transportation and

the public sector. Last but not least, it helps the country to meet its environmental targets and ameliorate the life conditions in its cities and towns.

Forced by the above facts, rose the idea of extending the gas supply network using "virtual pipelines". Instead of waiting the incumbent company to extend pipes network in the West part of the country and find a solution to supply the islands, the transportation of LNG to the West and its regasification afterwards seems a quick and economically and technologically viable proposal. There is mature and appropriate technology to support the technical viability of the project as far road transportation of LNG and small regasification plant is concerned. Furthermore, the huge size of the area that remains without natural gas supply bears out the assumption that in this case is hidden a real business opportunity.

All in all, this work will examine the actual status of gas market. It will make a proposal for a technically and economically viable project of "virtual pipes network". It will present available technologies and set the criteria of optimal selection. Finally, it will propose a business organisation that exceeds the simple energy trading. A presentation of a win-win business approach which benefits both entrepreneur and local consumers. The last will give an estimate also of the business success of the project.

Chapter 1: Energy Consumption and Supply in Greece

Greece, according to the World Bank (WB, 2015), is ranked 45th economy among the 214 countries of the world with its GDP to reach the 237,592 millions of US dollars. Greek GDP has declined severely last six years. As much as deep the recession of the last years may be, an economy of that size needs significant amounts of energy.

1.1 Energy Consumption

Gross inland energy consumption in 2013 was 24.4 million tones of oil equivalent (Mtoe) or 283.8 TWh. There is a drop in energy consumption during economic crisis from the peak of 2008, 31.8 Mtoe or 369.8 TWh to the consumption level of 1995 approximately (EUROSTAT, 2015).

In the **Table 1** is shown the gross inland consumption in Greece by type of fuel. There is

Table 1: Gross Inland Energy Consumption in Greece by Fuel Type

Year Fuel (ktoe)	2008	2009	2010	2011	2012	2013
All Fuels	31,836.4	30,471.6	28,725.2	27,789.0	27,760,0	24,358.3
Solid Fuels	8,320.5	8,425.5	7,863.0	7,887.0	8,135.7	6,980.7
Total Petroleum Products	17,813.6	16,829.8	14,973.7	13,483.9	13,234.2	11,342.7
Natural Gas	3,506.1	2,971.0	3,234.5	3,972.2	3,662.1	3,236.3
Renewable Energy	1,709.5	1,865.7	2,131.3	2,139.9	2,449.9	2,615.3
Waste (Non-Renewable)	4	4	32.0	28.1	14.9	21.1

Source*:* (EUROSTAT, 2015)

a decline of 23.5% of the energy consumption from 2008 to 1013. For petroleum products is higher, 36.4% while for natural gas is only 7.7%. Oil products declined steadily in contrast to gas, which fluctuated.

The energy consumption by sector can be seen in the following **Table 2.** Although figures are from 2009, it is obvious the sluggishness of the industrial sector, which is in the third position while in the others OECD countries, is second.

Table 2: Share of Total Final Consumption by Sector for 2009

Sector	Transportation	Residential	Industry	Services	Agriculture
Share (%)	41	24	21	10	5

Source: (IEA, 2011)

Since the study at hand is focusing on the natural gas market, it is very informative for one to see the natural gas consumption by sector (see **Table 3)**. Electric generation is by far the sector that consumes most of the natural gas in the Greek market. The abbreviations EPA are referred to the monopolistic distributors and retailers of natural gas in the prefectures of Thessaloniki and Attica and in the region of Thessaly. Detailed description of the Greek natural gas system will be done in the next chapter.

Table 3: Natural Gas Consumption by Sector for 2014

Sector	Power	Industry	EPA	Commercial	Transportation
Energy (GWh)	16,700	7,600	5,810	100	110
Share (%)	55	25	19	0.33	0.59

Source: (DEPA, 2014)

1.2 Energy Supply

Leaving apart renewable energy and waste, Greece produced, in 2012, 8 Mtoe of solid fuels (lignite) and 0.1 Mtoe of crude oil. Their share to total primary energy production was 77.7% and 0.9% respectively. However, this production is not enough to cover country's energy needs. The rest of the energy needed is imported in the form of crude oil and natural gas. Greece's net imports of primary energy, in 2012, were 20 Mtoe. The energy dependence of the country, in 2012, was 66.6% and since 2002 remains well above 65% (EUROSTAT, 2015).

In the **Table 4** the countries that supply Greece with crude oil are shown and in the next

Table 4: Crude Oil Exporters to Greece and their Share (2010)

Countries	Russia	Libya	Iran	Saudi Arabia	Kazakhstan	Iraq
Share (%)	38	15	14	12	10	9

Source: (IEA, 2011)

Table 5 the natural gas providing companies and their country of origin for 2010 and 2014 respectively are presented. It is apparent that Russia is the major energy supplier for Greece as far as hydrocarbon fuels are concerned.

Table 5: Natural Gas Exporters to Greece and their Share (2014)

Countries	Gazprom (Russia)	Sonatrach (Algeria)	BOTAS (Turkey)
Share (%)	65	17	18

Source: (DEPA, 2014)

Natural gas has slow penetration into Greek market. Although, Natural gas was introduced in Greek market in 1997, it did not displace crude oil products. There are still many consumers, which use expensive and polluting fuels. Polemis (2007) studied the industrial energy demand in Greece from the year 1970 to 2004. Industry is a very energy intensive sector. However, he points, "*energy switching in industrial sector in Greece is still limited"* (ibid. p.4046) because there is absence of substitutes such as, natural gas, LPG and biofuels.

He concludes: *"there was not found signs of structural change in industrial demand. That is because Greek manufacturing is rather sluggish and is strongly characterized by low efficiency as a result of the low degree of substitutability between the sources of energy".* (Ibid. p. 4049)

This, however, happened in 2004; natural gas monopolistic market was in its "infancy". Since then, many events, political and economic, have set a new framework for the competitiveness of the Greek industry. All economic sectors in their struggle with economic crisis and their effort to boost exports have started to rethink seriously the energy cost. Energy efficiency contributes to the increase of economy's productivity. More than a decade EU tried to increase energy saving and reduce energy intensity. In a certain extent, that has happened. Up to 2010, energy intensity in Greece appears to decline and to approach mean EU-28 as it declines too, but increases afterwards. In **Table 6** the best, the worst, the mean and the Greek energy intensity are shown.

Table 6: Energy intensity of the economy, 2002-12, (kg of oil equivalent/1 000 €)

Year / Countries	2002	2005	2008	2009	2010	2011	2012
EU-28	168.2	163.9	151.0	148.9	151.6	144.0	143.2
EU-18	158.0	156.6	145.0	143.3	145.9	138.4	137.9
Greece	173.3	162.7	151.3	149.5	148.3	154.4	165.7
Ireland	107.6	92.4	89.3	89.5	92.5	83.7	82.8
Bulgaria	962.9	849.4	711.7	661.4	668.8	705.5	669.9

Source: (EUROSTAT, 2014)

It is evident that the most competitive economies are those that use energy more efficiently. Fuels affect the energy efficiency and constraint technological choices. Natural gas is a versatile fuel and can be used from internal combustion engines to fuel cells. It can be used as well as for CHP installations or maritime fuel. Finally, it can be in gaseous (pipes, CNG) or liquid phase (LNG) giving many alternatives for its transportation and its final use.

Chapter 2: Natural Gas Transmission and Distribution System in Greece

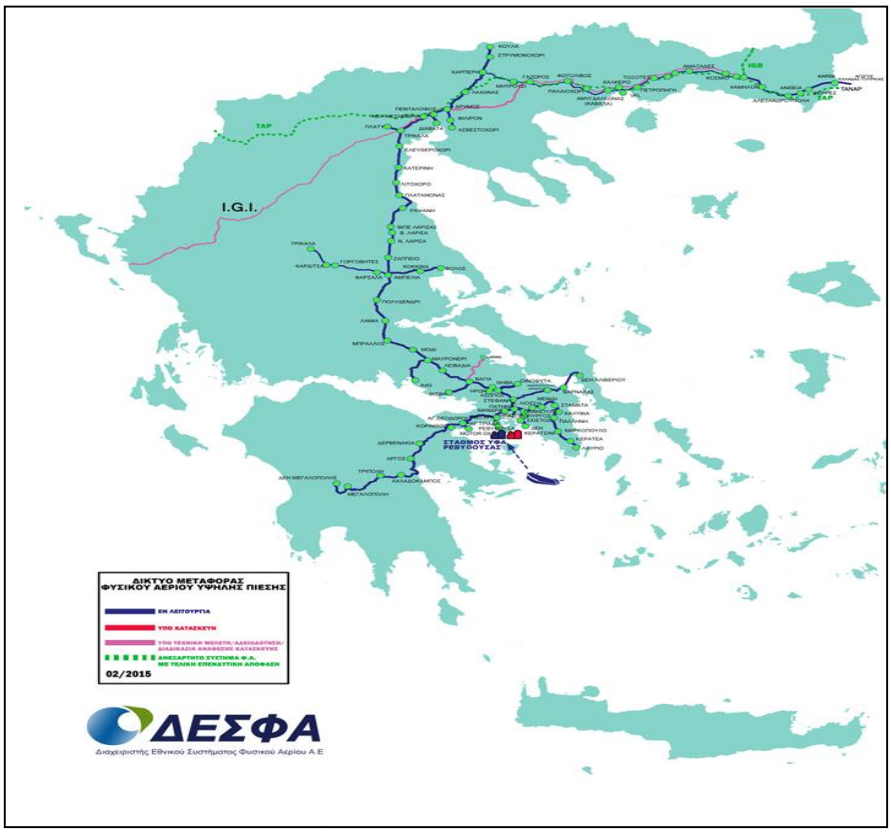
The present work will propose the establishment of a natural gas "virtual pipelines network" in West Greece. Subsequently, it will be helpful a brief presentation of the Greek natural gas system and its operation.

The Greek natural gas system is divided in high, medium and low pressure, 70bar, 19bar and 4bar respectively. High pressure pipelines transport natural gas from entrance stations to main areas; medium pressure transports natural gas from metering and regulation stations to towns and big industries; and low pressure distributes it to residential, commercial and industrial consumers.

2.1 Natural Gas Transmission System

The main transmission pipeline starts from the Greek-Bulgarian borders, Promachonas, and after running 512km ends in Attica. There are twelve braches with total length of 947km **(Figure 1)**.

Figure 1: Greek natural gas transmission system



Source: (DESFA, 2007)

Those branches are supplying with natural gas the regions of Eastern Macedonia, Thrace, Thessaloniki, Platy, Volos, Trikala, Oinofyta, Antikyra, Aliveri, Korinthos, Megalopoli, Thisvi and Attica (DESFA, 2007). Additionally to pipelines, there are equipment and installations such as, border metering stations, compression stations, metering and regulating downstream stations, control and dispatching centres as well as maintenance and operation centres. All the above constitute the National Natural Gas Transmission System (NNGTS). The NNGTS is a natural monopoly. Namely, it is a unique transmission infrastructure whose tariffs are regulated by Regulation Authority of Energy (RAE) and it can be used by all natural gas trading companies and eligible customers.

As can be seen in **Figure 1**, there are three entry points of natural gas in Greece, Sidirokastro, to the Greek Bulgarian borders, Kipoi to the Greek-Turkish borders and the Liquefied Natural Gas (LNG) receiving and regasification terminal at Revythousa Island, Attica.

Table 7: Technical Capacity of NNGS Entry Points

Entry point	Technical Capacity[1]	
	(MWh/d)	(Nm^3/d)
Sidirokastro	121,000.000	10,630,069.93
Agia Triada (LNG Terminal)	150,263.500	13,134,921.33
Kipoi	48,719.000	4,258,653.85

Source: (ibid 2007)

Their technical capacity is shown in **Table 7**. LNG terminal appears to have an impressed capacity, 20% higher of the main entry from Bulgaria and three times higher of Kipoi. Taking into account the fact that the LNG terminal is undergoing an upgrading which will permit the accommodation of bigger ships, additional storage of 95,000 m^3 of LNG and an increase of the gasification rate, Agia Triada will become the foremost national system's natural gas entry.

NNGTS' Operator in Greece is DESFA S.A., a 100 % subsidiary of Public Gas Corporation (DEPA). DEPA is the incumbent wholesale trader and operator of the distribution network of natural gas in Greece. The other upstream TSOs in Bulgaria and Turkey are BULGARTRANSGAZ and BOTAS respectively.

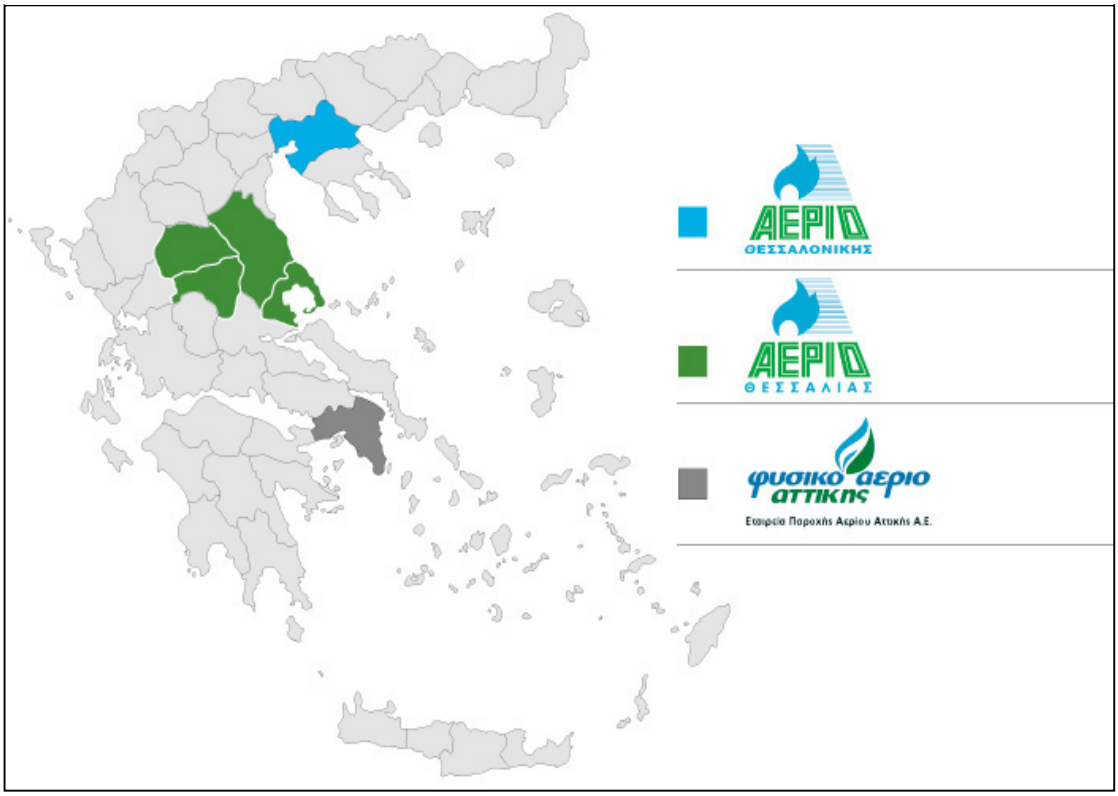
[1] "Technical capacity" is defined the maximum invariable capacity which can be offered by the Operator to the transmission system users taking into account the integrity and the operational requirements of the NG National Transmission System (DESFA 2007).

2.2 Natural Gas Distribution System

As it was referred previously operator of natural gas distribution network in Greece is DEPA. It is a state owned and controlled company, 65% Greek State and 35% Hellenic Petroleum.

DEPA has the right to exploit exclusively the natural gas distribution network in Greece. However, as it will be exposed in the next chapters the monopolistic foundation of the Greek market is abandoned. Hence, it is unbundled and becomes open to competition. Nonetheless, Depa owns and operates 5,600 km of medium and low pressure distribution networks directly or through its subsidiaries Gas Distribution Companies (EPA).

Figure 2: Gas Distribution Companies



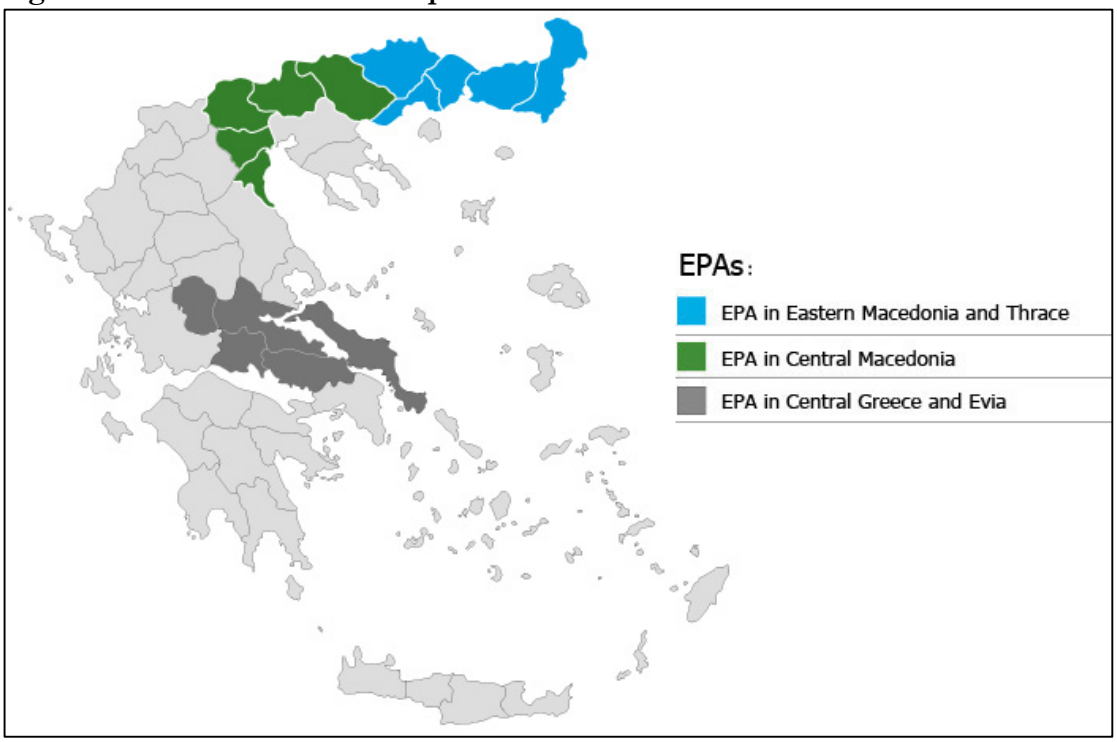
Source: (DEPA, 2014)

Currently, as can be seen in **Figure 2** there are three EPAs, in the Prefectures of Thessaloniki and Attica and in the region of Thessaly (DEPA, 2014). DEPA holds the 51% of the companies whilst the 49% has been conceded to strategic partners, Shell in Attica and Eni in Thessaly and Thessaloniki.

In those areas live the absolute majority of the Greek population whereas they create country's vast part of the Gross Domestic Product (GDP). Because the vast part of the

country, even geographically, has not access to natural gas distribution network, DEPA plans the expansion of it in neighbouring to the main transmission pipeline regions. **Figure 3** displays the EPAs to be established in the proximate future.

Figure 3: Gas Distribution Companies to be established

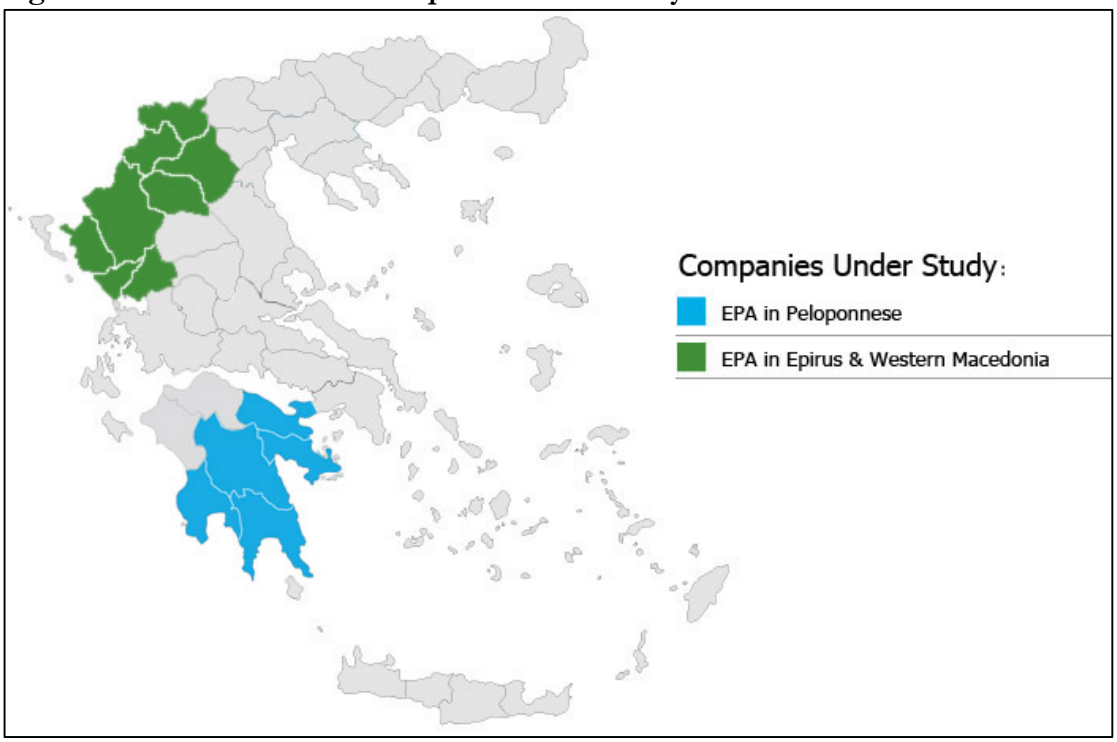


Source: (DEPA, 2014)

These areas are: a) Eastern Macedonia and Thrace b) Central Macedonia c) Central Greece and Evia. At the same time DEPA is studying the expansion of its network farther south and west in an effort to cover almost all mainland. Even in that case, a part at west of the country, the region of West Greece, remains without accesses to natural gas network and the islands. The areas under study are Peloponnese, Epirus and Western Macedonia **(**see **Figure 4)**. However, in a brochure published by DEPA in 2012 there was not any reference to the EPA of Epirus and Western Macedonia (DEPA, 2012). The development of natural gas distribution network in the previously mentioned areas depends from the expansion into them principally of the National Natural Gas Transmission Pipeline. As early as July 2007, DESFA included the extension of the high pressure pipeline from Komotini (Thrace) to Thesprotia (Epirus) in its development plan with a budget of 1,100,000,000 €. This project is cited until now in the development plans of the company, but there is not execution timetable.

Anyway, the region as it will be shown in the following chapters is considered without Gas Distribution Company i.e. open to entrance of competitors.

Figure 4: Gas Distribution Companies under study



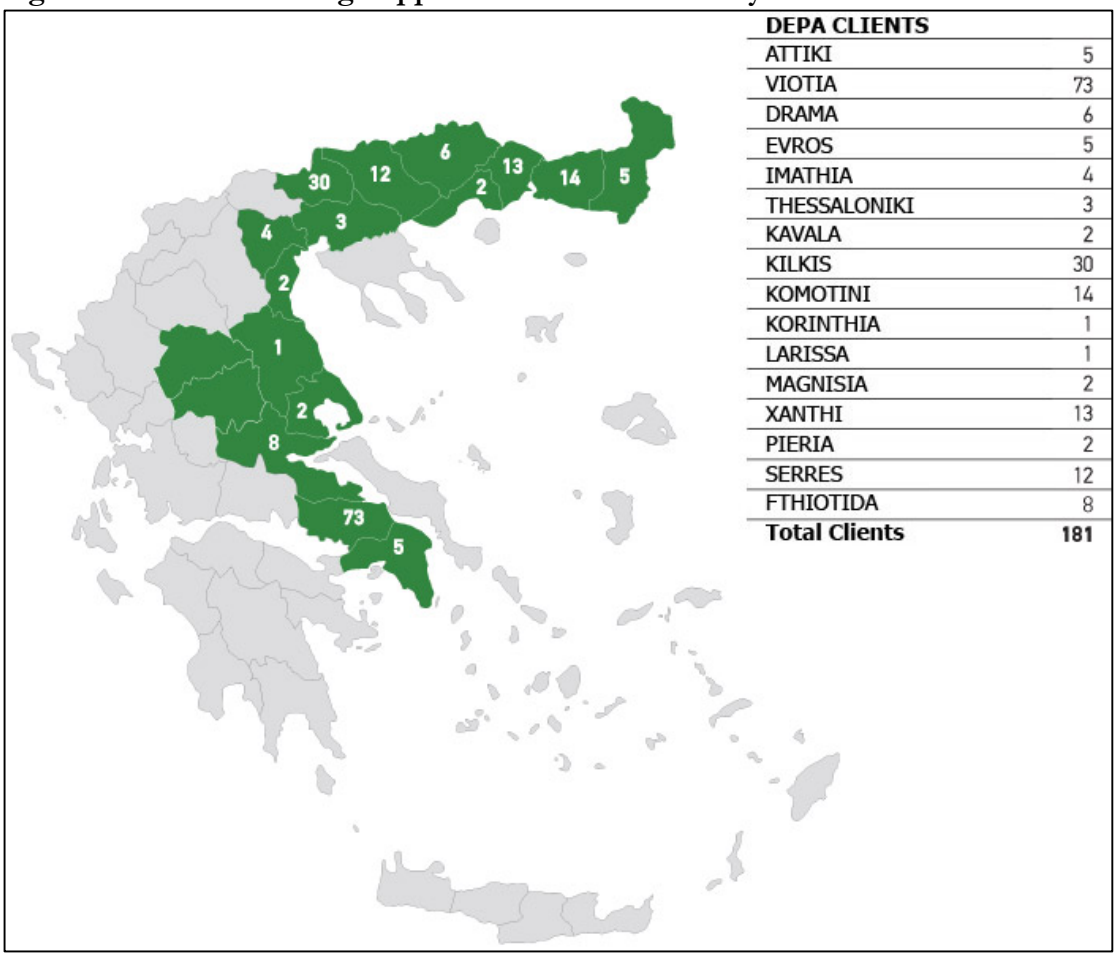
Source: (DEPA, 2014)

DEPA supplies also industrial natural gas consumers who are close to the main pipelines. They are eligible customers, i.e. they have the right to choose their supplier. According to DEPA, they consume more than 2,200 MWh of natural gas (Gross Calorific Value) or approximately 200,000 Nm^3 of gas annually. They are summed up in 167 small and 25 large industrial enterprises with a total annual consumption above the 100GWh (DEPA, 2014).

However, the interesting part of the above is their distribution geographically. **Figure 5** shows the regions and the number of the businesses in each of them that use natural gas. Obviously, the map shows an asymmetry between the East and West part of the country. The businesses installed in the western regions have not the opportunity to use a cheaper and cleaner fuel such as natural gas. Furthermore, they have a disadvantage when they come to compete with other industries, which are installed in the Eastern regions or in EU countries with a ubiquitous natural gas network. This map demonstrates that it is essential for the economy of the western regions the development of a natural gas

network in a feasible form i.e. "virtual pipelines network". At the same time, this option is a business opportunity.

Figure 5: Industries Being Supplied with Natural Gas by DEPA



DEPA CLIENTS	
ATTIKI	5
VIOTIA	73
DRAMA	6
EVROS	5
IMATHIA	4
THESSALONIKI	3
KAVALA	2
KILKIS	30
KOMOTINI	14
KORINTHIA	1
LARISSA	1
MAGNISIA	2
XANTHI	13
PIERIA	2
SERRES	12
FTHIOTIDA	8
Total Clients	**181**

Source: (DEPA, 2014)

Chapter 3: Greek Natural Gas Market

The Greek Natural Gas market has a life of 19 years. Most of those years, it was a monopolistic market being served by the vertical integrated state owned DEPA. Greece as EU member, adopts the EU energy policy and legislation. Thus, Greece is moving, slowly though, towards an open to competition natural gas market.

3.1 Legal Framework

European

The European Community attempted the establishment of a European natural gas market by issuing three directives, which accompanied by a number of regulations. The three directives used to be called "three energy packages" (Farantouris, 2012).

1) June 22, 1998 the directive 98/30/EC concerning common rules for the internal natural gas market
2) June 26, 2003 the directive 2003/55/EC and the regulations 1775/2005/EC and 796/2003. This directive repealed the 98/30/EC.
3) July 13, 2009 the directive 2009/73/EC and the regulation 715/2009/EC. This directive repealed the 2003/55/EC.

The above directives opened gradually the natural gas market of the EU member states, which had the obligation to adopt them in their national legislation.

National

The first law that established the monopolistic Greek natural gas was the 2364/1995, which is still in force.

However, Greece was obliged to follow EU's energy policy concerning the formation a European energy market (electricity and natural gas). Thus Greek parliament adopted the directive 2003/55/EC with the law 3428/2005 on "The Liberalization of the Natural Gas Market". The last was followed by a number of Ministerial Decisions, which gave complete implementation of the EU directive.

In 2011, Greece followed EU's "third package" by adopting the directive 2009/73/EC with the law 4001/2011. This law replaced or supplemented parts of the previous one whilst added new rules for the electricity and natural gas market. In between, Ministerial

Decisions were issued concerning regulations and amendments of previous legislation. All the relevant legislation is available at the site of Regulatory Authority of Energy (RAE) (http://www.rae.gr). RAE, also, issued the "Standard Natural Gas Transmission and LNG Facility Usage Agreements" (decision No 611/9.4.2010).

Finally, two important legislative topics are worth mention if one is to enter in the natural gas market: 1) license procedure and 2) eligible customers i.e. customers not being captive by the monopolistic part of the natural gas market or free to decide from whom to purchase natural gas.

1) With the Ministerial Decision Δ1/Α/5815/19.4.10 concerning "Natural Gas Licenses Regulation", licensing application is defined according to the activity to be pursued in the natural gas market; 1) License for independent natural gas system 2) License for system operation 3) License for natural gas distribution 4) License for natural gas supply 5) License of own and operate the national natural gas system (Dagoumas, 2012).

2) The article 82 of the Law 4001/2011 as have been amended by article 5 of the Law 4336/2015 defines the eligible customers of the Greek natural gas market. Therefore, among the others, eligible customers are: 1) Power producers 2) customers located out of the territories of existing or to be established EPAs (see **Figure 2 & 3**) 3) territories where EPAs are under study 4) Non-residential customers located within the territories of to be established EPAs.

The list of the eligible customers is not exhaustive and as early as 2018, it is expected Greek natural market to be entirely free to competition in all over country's territory. The legal framework, presented above, permits the exploitation of the business opportunities arisen in the Greek natural gas market.

3.2 Competition

As it was said in chapter 3 national natural gas transmission system is a natural monopoly. For that reason, there is only one owner and operator. There is not competition and its charges of using the pipelines are fixed and regulated. However,

there is possibility to exist an independent transmission system such as Trans Adriatic Pipeline (TAP).

Downstream, the distribution network is an exclusive monopoly for the residential customers. However, by 2018, it will be converted to natural monopoly through which traders will supply their customers. Charges of using it will be regulated and transparent. Consequently, natural gas market as early as 2018 will be completely open to competition.

There are already seventeen authorized companies in the Greek natural gas market. The list of which is presented in the **Table 8**. The last column indicates the authorized activity. (See **Appendix A** with the list of applications to RAE)

Table 8: List of authorised companies by RAE

REGISTRY OF NATURAL GAS AUTHORIZATIONS (As of 26/03/2015)				
No	RAE'S OPINION/DECISION NUMBER*	MINISTRY'S DECISION NUMBER	AUTHORIZATION HOLDER	AUTHORIZATION FOR
1	OPIN. 356/2010	Δ1/A/26859/18.01.2011 A.T. Δ1/A/15827/07.07.2011	DEPA S.A.	NATURAL GAS SUPPLY AUTHORIZATION
2	OPIN. 357/2010	Δ1/A/26860/18.01.2011 A.T. Δ1/A/15830/07.07.2011	PROMETHEUS GAS S.A.	NATURAL GAS SUPPLY AUTHORIZATION
3	OPIN. 358/2010	A.T.Δ1/A/15826/07.07.2011 TP	AXPO HELLAS S.A.	NATURAL GAS SUPPLY AUTHORIZATION
4	OPIN. 375/2010	Δ1/A/487/07.02.2011 A.T.Δ1/A/15828/07.07.2011	M AND M GAS CO	NATURAL GAS SUPPLY AUTHORIZATION
5	OPIN. 3/2011	A.T. Δ1/A/15829/07.07.2011	HELLAS POWER S.A. (formerly known as AEGEAN POWER S.A.)	NATURAL GAS SUPPLY AUTHORIZATION
6	OPIN. 27/2011	Δ1/Α/οικ.18723/09.08.2011	EDISON HELLAS S.A	NATURAL GAS SUPPLY AUTHORIZATION
7	OPIN.29/2011	Δ1/A/19466/19.08.2011	GASTRADE A.E.	INGS AUTHORIZATION
8	OPIN. 28/2011	Δ1/A/19465/19.08.2011	ENIMEX A.E.	NATURAL GAS SUPPLY AUTHORIZATION
9	DEC. 217/2012	N/A	TERNA S.A.	NATURAL GAS SUPPLY AUTHORIZATION
10	DEC. 870/2012	N/A	HERON THERMOELECTRIC S.A.	NATURAL GAS SUPPLY AUTHORIZATION
11	DEC.532/2013	N/A	GUNVOR INTERNATIONAL B.V.	NATURAL GAS SUPPLY AUTHORIZATION
12	DEC.233/2014	N/A	GREEK ENVIRONMENTAL & ENERGY NETWORK S.A.	NATURAL GAS SUPPLY AUTHORIZATION
13	DEC.431/2014	N/A	TRANS ADRIATIC PIPELINE AG	INGS AUTHORIZATION
14	DEC.502/2014	N/A	GASELA GmbH	NATURAL GAS SUPPLY AUTHORIZATION
15	DEC.559/2014	N/A	HELLAS EDIL S.A.	NATURAL GAS SUPPLY AUTHORIZATION
16	DEC.655/2014	N/A	GREENSTEEL – CEDALION COMMODITIES S.A.	NATURAL GAS SUPPLY AUTHORIZATION
17	DEC.96/2015	N/A	WATT AND VOLT S.A.	NATURAL GAS SUPPLY AUTHORIZATION

Source: (RAE, 2015)

DESFA should be added to the above list as authorized owner and operator of the national natural gas system. Not all of the above companies are active in the natural gas market. Eurostat (2014), in "Energy, transport and environment Indicators", gathered information for European and member states' electricity and natural gas markets. In some topics there were not data available from Greek market. However, it was evident that the Greek market resembled to monopolistic, dominated by an incumbent company. The following **Table 9** depicts the status of the market. It seems that something changed

in the last years. Nonetheless, there is a lack of available data for extracting unequivocal conclusions.

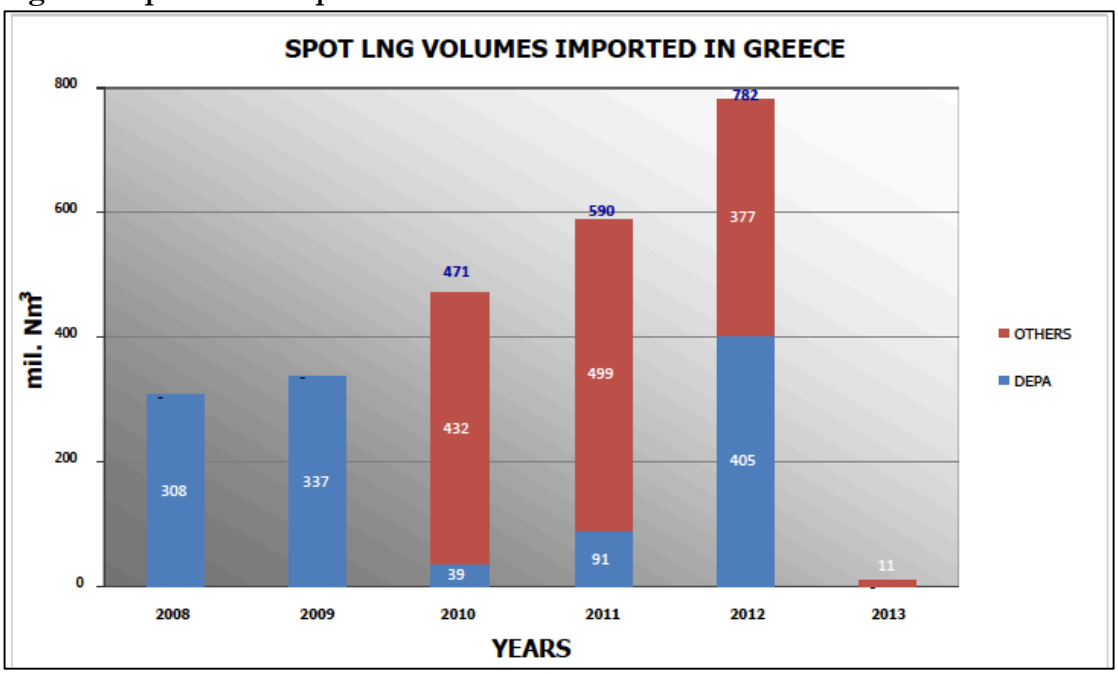
Table 9: Status of the Greek Natural Gas Market

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Nº of entities bringing NG into the country	-	-	1	1	1	1	1	3	:	:
Market share (%) of the largest import gas company	-	-	-	-	100.0	100.0	100.0	88.6	:	:
Nº of retailers selling natural gas to final customers	1	2	4	4	4	4	4	4	:	4
Nº of main natural gas retailers [1]	1	2	1	1	2	2	3	3	:	4
Market share (%) of the largest natural gas retailer	-	-	-	-	87.8	87.8	82.5	84.7	:	33.0

(1) Retailers are considered as 'main' if they sell at least 5 % of the total natural gas consumed by final customers.
(:) Information not available (-) Not in time ranges
Source: Data gathered by the author from (EUROSTAT, 2014)

Up to 2010, DEPA and its subsidiaries were the only players in the market. Later, the entrance of new competitors started as the dates of the applications in the **Table 8** reveal. Unfortunately, there are not available data for the last five years. There was, however, another company (M&M) that imported LNG in Greece between 2010 and 2015 (see **Figure 6**).

Figure 6: Spot LNG Imports in Greece 2008-2013

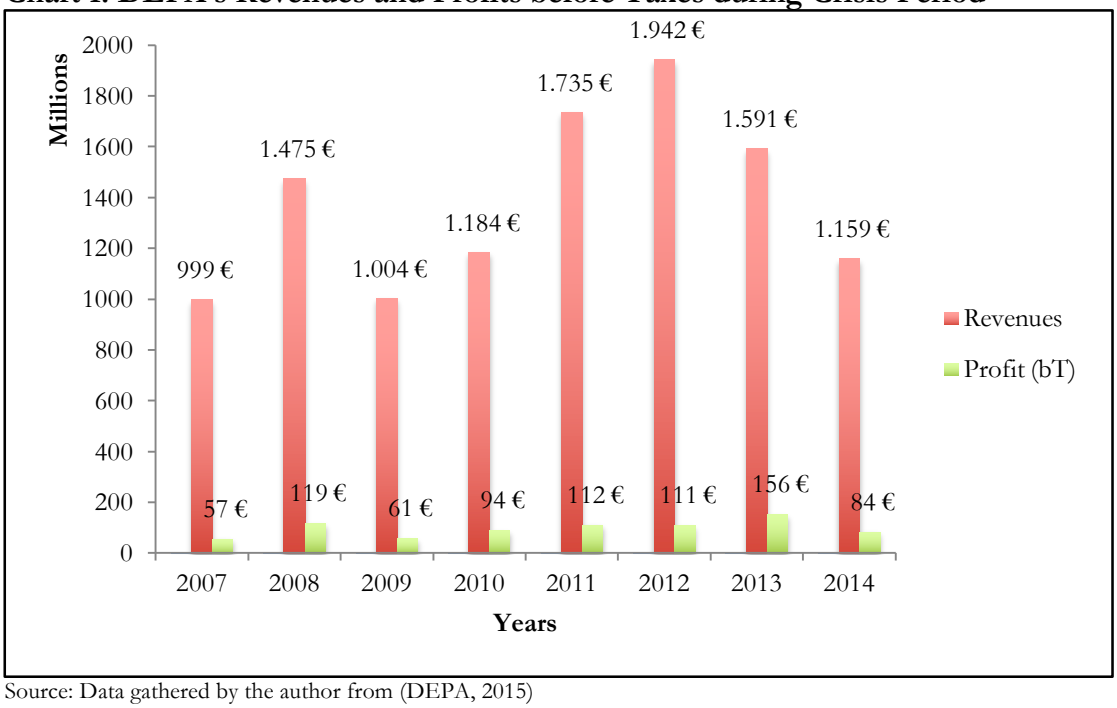


Source: (Prometheus Gas, 2014)

DEPA continues to be the most important stakeholder of the natural gas market in Greece. For that reason, it is worth presenting more information about its activities and future plans.

In 2014, DEPA sold 33 MWh (2.6 bcm) of natural gas descending from the 42,6 MWh in 2013. Sales had declined at a rate of 6% from 2011 to 2013. Revenues and profit before taxes are presented in the **Chart 1.**

Chart 1: DEPA's Revenues and Profits before Taxes during Crisis Period



Source: Data gathered by the author from (DEPA, 2015)

2009 was the first year of economic crisis and DEPA had a drop in its revenues. However, for the next three years the revenues increased impressively and they doubled in 2012. After, they turned downwards to come close 2009 level again. The drop was due to the conditions of the electricity market. Independent electricity producers used less natural gas for electricity generation.

Subsequently, DEPA desires to strengthen its position in the existent market. At the same time, it will start to search new customers outside the boundaries of EPA's i.e. to serve consumers without connection to pipelines network. For that reason, DEPA applied to RAE for its supply license modification/complementation so that it will be able of serving remote consumers. Furthermore, a pilot CNG installation in the premises of a large industry in the region of Central Greece was studied (DEPA, 2014). (See also **Appendix B** with the announcement of DEPA for its application for license

modification to RAE). Having the above in mind, it is recognized that DEPA is the leader of the Greek natural gas market followed by the rest companies. It, also, sets the gas price having always the possibility to recover likely to occur loses by its participation in other companies such as DESFA and EPAs.

How easy is, then, for a company to enter and compete incumbent in the natural gas market?

Polemis and Fafaliou (2010) studied in depth the Greek natural gas market by applying Porter's five forces model. **Table 10** shows the factors that affect competition. The threats and barriers are ranked from 1(insignificant) to 5 (extremely important).

Table 10: Competitive Factor's Ranking for the Greek Narural Gas Market

Factors	1	2	3	4	5
Threat of substitute products				✓	
Threat of new entrants	✓				
Barriers to entry					
Capital requirements				✓	
Legal restrictions					✓
Economies of scale and cross-shareholdings			✓		
Competition rivalry within the industry				✓	
Bargaining power of suppliers					✓
Bargaining power of customers			✓		

Source: (Fafaliou & Polemis, 2010)

Legal restrictions and supplier's power are the most important factors, followed by substitute products e.g. electricity and light oil, capital requirements and competition within industry. It should be admitted that legal environment has changed considerably favouring competition.

In contrary, bargaining power of suppliers remains high, because: a) Greece's indigenous production is marginal b) imports come mainly from pipelines with long-term contracts, with take or pay clauses.

Currently, DEPA has supply contracts with the companies presented in **Table 11**.

Table 11: Companies with Long-term Contracts with DEPA

Company	Source (Pipeline and LNG)	Contract Expiration
Gazprom	Russia	2026
Sonatrach (LNG)	Algeria	2021
BOTAS	Turkey	2021

Source: (DEPA, 2014)

Fafaliou & Polemis (2010, p. 175) say relatively to those contracts: *"These clauses* [Take or Pay] *might have anticompetitive effects on the (already limited) competition in the downstream market, thus prohibiting any access to gas supply within the boundaries of a specific spatial area and being able to block the market to new entrants. Moreover, take or pay clauses may also effectively prevent upstream producers from entering Greek downstream market. This is done by deterring the potential competitors from the downstream market".*

Taking in account the above analysis and having in mind that competition rivalry occurs in the areas with pipelines network, a new entrant can focus on far-off consumers. Furthermore, LNG can be used for two reasons: a) more energy transported per kilometer b) LNG could be bought easily in spot markets avoiding supplier's power.

3.3 Customers, Costs and Prices

Natural gas is not the opportunity fuel in Greece. Yet, as can be seen in **Table 11**, customers have significant bargaining power. The switch to natural gas incorporates important costs for the customers, who may be reluctant to pay. Recently, EPAs assume part of connection costs as an offer for attracting new customers.

Table 12: Figures from Natural Gas Industry

End 2013	Total length of pipelines (in kilometres)	Number of gas customers (in thousands)*	Number of employees	Number of natural gas vehicles**	Gas power generation capacity installed (in megawatts)
AUSTRIA	42 900	1 351	3 010	8 575	5 119
BELGIUM	74 795	3 226	7 000	344	6 851
BULGARIA	6 710	69	875	61 320	990
CROATIA	19 904	647	2 053	155	1 202
CYPRUS	0	0	0	0	0
CZECH REPUBLIC	77 489	2 860	3 037	7 100	838
DENMARK	17 924	420	1 400	15	3 000
ESTONIA	2 880	52	335	230	200
FINLAND	3 218	34	490	1 680	2 842
FRANCE	232 027	11 301	32 000	13 300	15 597
GERMANY	510 000	21 179	34 229	97 969	26 658
GREECE	7 125	307	848	830	4 900
HUNGARY	89 004	3 468	2 520	5 118	4 520
IRELAND	15 647	655	530	3	3 742
ITALY	288 091	22 941	36 319	846 523	52 108
LATVIA	6 146	443	1 267	350	1 141
LITHUANIA	10 307	559	1 364	380	2 658
LUXEMBOURG	3 089	84	210	261	492
MALTA	0	0	0	0	0
NETHERLANDS	133 546	7 152	9 500	6 879	12 654
POLAND	187 304	6 810	33 323	3 600	1 065
PORTUGAL	18 010	1 354	1 068	461	4 739
ROMANIA	53 666	3 282	40 918	0	4 020
SLOVAKIA	35 452	1 503	4 307	1 400	1 344
SLOVENIA	5 436	134	530	62	350
SPAIN	81 188	7 473	6 627	3 990	26 251
SWEDEN	3 220	40	250	46 713	790
UNITED KINGDOM	285 600	23 003	54 178	559	35 320
EU-28	2 210 677	120 348	278 188	1 107 817	219 391
SWITZERLAND	19 484	423	1 631	11 300	603
TURKEY	82 859	9 856	77 800	3 850	n/a

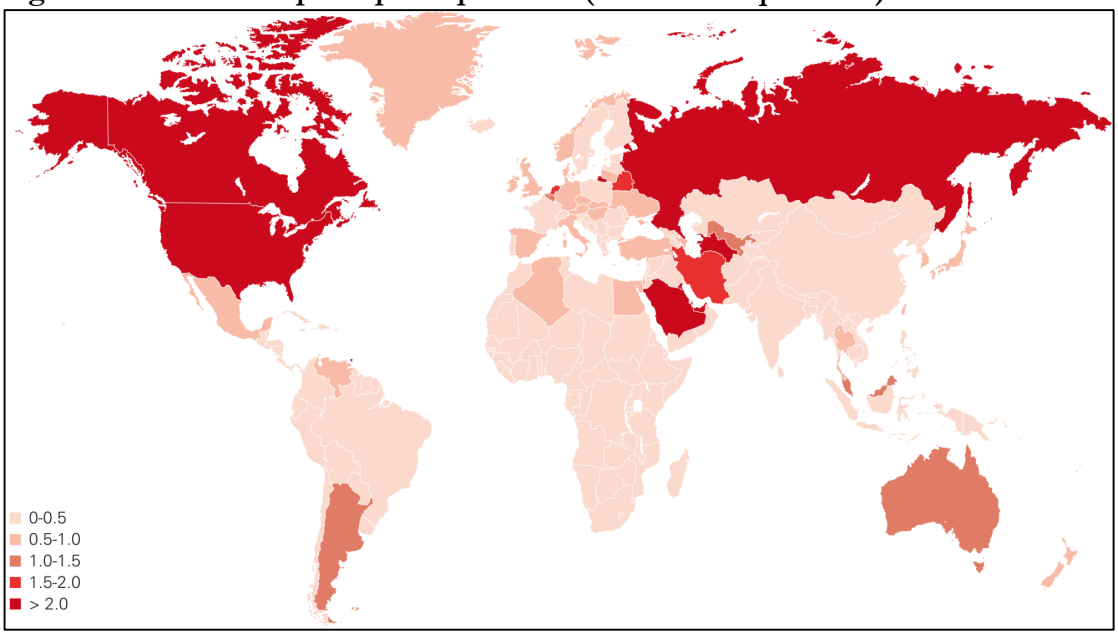
Source: (EUROGAS, 2014)

* Number of gas customers are counted by number of meters, and include domestic as well as non-domestic (industrial, commercial and other) customers, except Germany for which the number of domestic customers is equivalent to the number of dwellings supplied with natural gas for heating.
* * Eurogas and NGVA Europe. Note: Figures are best estimates available at the time of publication

Greece has less natural gas consumers than other comparable in size countries. For example, at the end of 2013 in Greece there were 307,000 customers while in Portugal 1,354,000 i.e. approximately four times more (see **Table 12**). This represents a huge business opportunity for the existing companies and for new entrants.

Another point of attention is the quantity of natural gas, measured in energy units, that is consumed per capita. The following **Figure 7** illustrates that Greece is among the countries with the less natural gas consumption per capita in the world i.e. less than 0.5 tones oil equivalent (5.8 MWh).

Figure 7: Gas consumption per capita 2014 (tonnes oil equivalent)



Source: (BP, 2015)

Conclusively, Greece has a significant potential of natural gas market expansion either by increasing the number of customers or by widening the uses of it.

Costs and Prices

Transmission Costs

The use of the national natural gas transmission system has a cost, which is well defined by the Regulatory Authority of Energy. This section of the market is a regulated natural monopoly. Every natural gas trader has access to the system at a known cost and with

fixed time intervals, 3-5 years. This time is called "regulating period". Overall costs include system deprecation, operational expenditures and a reasonable profit for the operator (Greek system, rate-of-return). Finally, transmission system's pricing does not dependent to the gas track and the distance run by gas, but to the entry and exit point (Entry-Exit system). In **Figure 8** entry and exit points are presented schematically.

Figure 8: Greek Entry-Exit Pricing System

Source: (Avlonitis, 2015)

There are two charges: a) quantity of natural gas (energy units MWh) transmitted by the system b) transmission capacity reserved. The following **Table 13** shows the cost of each entry and exit point for energy and capacity for the year 2015.

Table 13: Coefficients for Natural Gas Transmission Charges Calculation (2015)

Transmission System for each Entry and Exit	**MMS**$_i$ (€/MWh GCV/Day/Year)	**TQE**$_i$ (€/MWh GCV)
Entry Sidirokastro	132.5494	0.1177
Entry Kipi	121.5054	0.0904
Entry Ag.Triada	25.0586	0.0507
Exit Northeast Zone	65.7975	0.1320
Exit North Zone	254.8178	0.4042
Exit South Zone	359.5081	0.4900

Source: (DESFA, 2014)

Henceforward, the annual user charge (TCh) for natural gas transmission is calculated on the basis of the Transmission Tariffs as follows:

$$TCh = MMS \times TC + TQE \times TQ$$

Where, TCh € per year, MMS rate in € per MWh on the Peak Day each year, TC (maximum quantity of natural gas committed by operator to transmit) in MWh at the Peak day, TQE in € per MWh and TQ (annual natural gas quantity transmitted) in MWh per year.

The first part of the tariff, namely MMS x TC regards the Transmission System capacity charge, which depends on reserved capacity and the capacity realized by the User. The second part of the tariff, namely TQE x TQ regards the Transmission System quantity charge which depends on the natural gas quantity transmitted on the user's behalf (RAE, 2008).

An analogous pricing system will be used for the natural gas distribution system, when EPAs regions will be open to competition.

Imported Natural Gas Prices

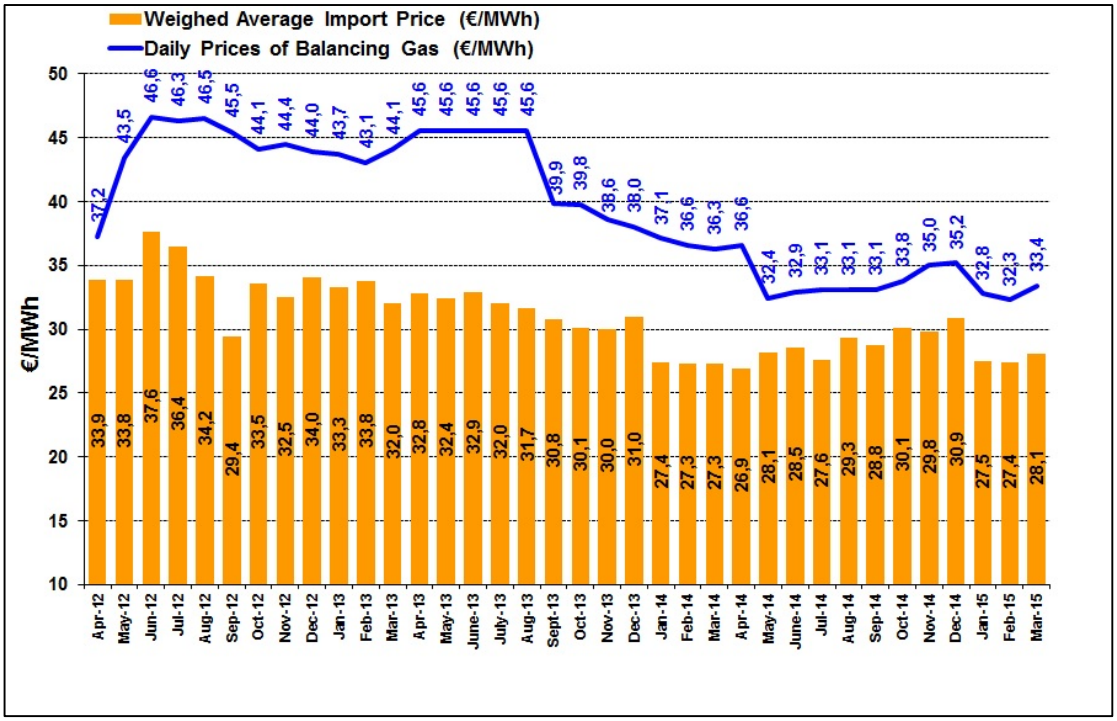
In Chapter 1 was explained that Greece is importing all natural gas needed since its production is insignificant. The companies, which import natural gas, have the obligation to submit to RAE the quantities imported and their prices. RAE, then, calculates the weighted average import price (WAIP) of Natural Gas in the NNGS of Greece, on a monthly basis. The calculated prices are published by RAE based on the last three years' data (see **Chart 2**). Blue line shows the prices of balancing gas during the NGGS operation. Those prices are given to RAE from system operator, DESFA. Bars are representing months and all the graph covers three years' period.

It is apparent that natural gas prices steadily decline last years. Two reasons are responsible for that. First, the initial supply contracts had expired and there was a request for price reduction, during their renewal negotiations. Second, gas prices are based on long-term oil indexed take-or-pay contracts. Oil indexed means that gas prices are following oil prices with a, usually, quarterly adjustment. Because last years' oil prices have sunk, natural gas followed their trajectory. It is not sure whether, in the future, gas industry will continue to use the oil indexed pricing, which is dominant in Europe, or will

switch to spot pricing. Market based pricing is more common in USA and Asia where LNG gas shipments are usual. However, the increase of the LNG availability may force gas industry in Europe to reconsider its pricing mechanism. Greece has proposed two more LNG terminals in North Greece (Kavala and Alexandroupolis), which have been included in European Projects of Common Interest.

As European energy market, and consequently Greek, is liberalized, it will be simpler for traders or second-tier players to buy gas from the spot market in favourable prices and gain market share.

Chart 2: Weighted Average Import Price of Natural Gas in the NNGS of Greece



Source: (RAE, 2015)

Natural Gas Retail Prices

End users buy natural gas from retailers or the incumbent if they are eligible customers. In the regions with pipelines network, natural gas supply has been conceded to EPA's i.e. gas supply companies. As was explained in Chapter 2, in their region EPAs are a kind of monopoly. They operate the distribution network and they set natural gas prices. EPAs are joint ventures of DEPA and Shell in Attica and Italian Eni in Thessaly and Thessaloniki. DEPA holds the 51% of the shares and its partners the 49%. Gas prices are categorized according to the type of the end user e.g. residential, commercial, CHP generator etc. The following **Table 14** shows the gas prices of the three EPAs, which operate in the Greek market, for month October 2015.

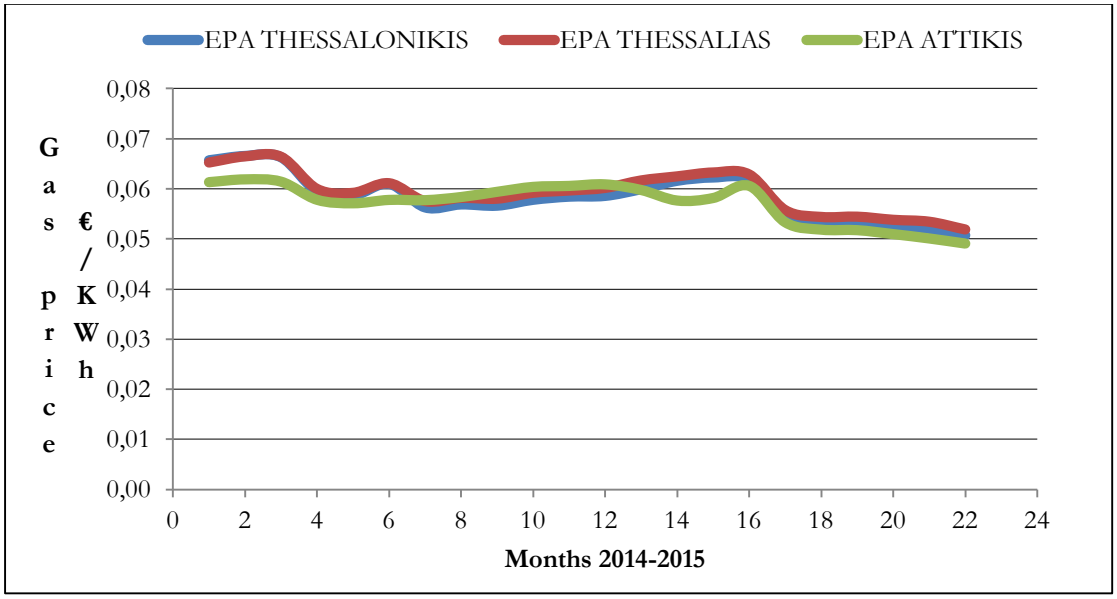
Table 14: Natural Gas Prices for October 15 by Three EPAs

Price Types / EPAs	T1 (cook-water)	T2 (heating)	T3 (prof)	T3C (chp)	T3D (air)
Units	€/kWh	€/kWh	€/kWh	€/kWh	€/kWh
Attikis	0.049141145	0.041141145	0.042568458	0.036374626	0.042568458
Thessalonikis	0.050726576	0.039421129	0.041055652	0.039002869	0.041055652
Thessalias	0.051857445	0.040363459	0.04202524	0.039923978	0.04202524

Source: Data elaborated by the author from (EPA Attikis, 2015) (EPA Thessalias, 2015) (EPA Thessalonikis, 2015)

The prices have turned downwards following the import prices showed in the previous section. The **Chart 3** depicts the prices for a period of almost two years. Lines move uniformly, which shows same price policy (see **Appendix C** with the prices of EPAs for 2014-2015). The three EPAs do not compete each other, since they have separate assigned areas. However, they follow similar pricing policy. No wonder, there are the same shareholders.

Chart 3: Natural Gas Prices Variation in the Last 22 Months



Source: Data elaborated by the author from (EPA Attikis, 2015) (EPA Thessalias, 2015) (EPA Thessalonikis, 2015)

Table 14 displays the charges for the energy content of the natural gas. There is, though, a constant or a capacity charge. The last differs depending on EPA and type of customer. For example, EPA of Thessaloniki and Thessaly charge a constant of 0.127535343€ and 0.232490953€ per day for T1 and T2 customer types respectively i.e. residential. On the

other hand, EPA Atiikis escalate charges according to capacity demanded and to type of customer.

The prices, on their own, could not say something important for the Greek market. The tricky issue at this point is the profit margin for the companies downstream in the market. As it was shown in the previous section, imported weighted natural gas average price was **28.1 €/MWh** for March 2015 i.e. the price that DEPA acquired the natural gas and sold it to customers and its EPAs.

A comparison of the import price and the price offered to customers by EPAs is illustrative for the profit margins of the different parts (natural monopoly and traders) of the Greek natural gas system. In the following **Table 15**, the percentage increase in natural gas price is shown for the month of April 2015. It is assumed natural gas price in April reflects the March's import price.

Table 15: % Increase of Natural Gas Price from Import to the End-User (April 2015)

Price Types EPAs	T1 (cook-water)	T2 (heating)	T3 (prof)	T3C (chp)	T3D (air)	T-indus
Units	€/kWh	€/kWh	€/kWh	€/kWh	€/kWh	€/kWh
Attikis	0.060612511	0.052612511	0.058039824	0.046533216	0.052727048	0.046533216
Thessalonikis	0.061827859	0.050522412	0.052156935	0.049549088	0.052156935	
Thessalias	0.062845346	0.05135136	0.053013141	0.050362484	0.053013141	
% margin for						
Attikis	116%	87%	107%	66%	88%	66%
Thessalonikis	120%	80%	86%	76%	86%	
Thessalias	124%	83%	89%	79%	89%	

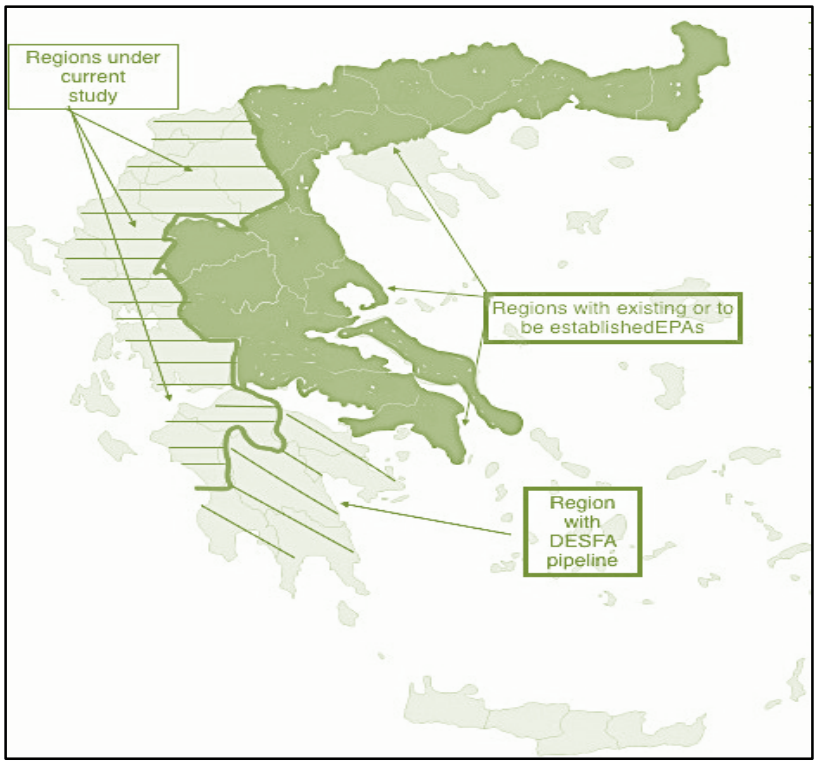
Source: Elaborated by the author, Data from (EPA Attikis, 2015) (EPA Thessalias, 2015) (EPA Thessalonikis, 2015)

EPA Thessaloniki and EPA Thessalia affirm that 95% and 90% respectively of their customers belong to the category T2. The margin for the Greek natural gas system in this category is between 80% and 87% (see **Table 15**). The profit temptation is, highly, motivating an entrance attempt.

Chapter 4: Regions Without Access to Natural Gas Pipelines

It has been discussed in previous chapters that important parts of the Greek territory are out of the range of natural gas pipelines network. For some of them there are plans and for other only wishes, that in the near future natural gas will be available. Those regions are Western Greece, Epirus and Western Macedonia on mainland, and the entire Greek archipelago. In this chapter the regions on mainland will be examined.

Figure 9: Regions of Greece and their Status Relatively to Natural Gas Pipeline Network



Source: Elaborated by the Author

In the following sections, Western Greece, Western Macedonia and Epirus will be presented. As can be seen in **Figure 9**, they form a solid geographical area at Northwest and West part of the country.

4.1 Area & Population

The area and the population of the three regions are presented in **Table 16.** Their population is 1,300,341 inhabitants and their area is 30,004 km^2, 12% and 23% of country's total population and area respectively.

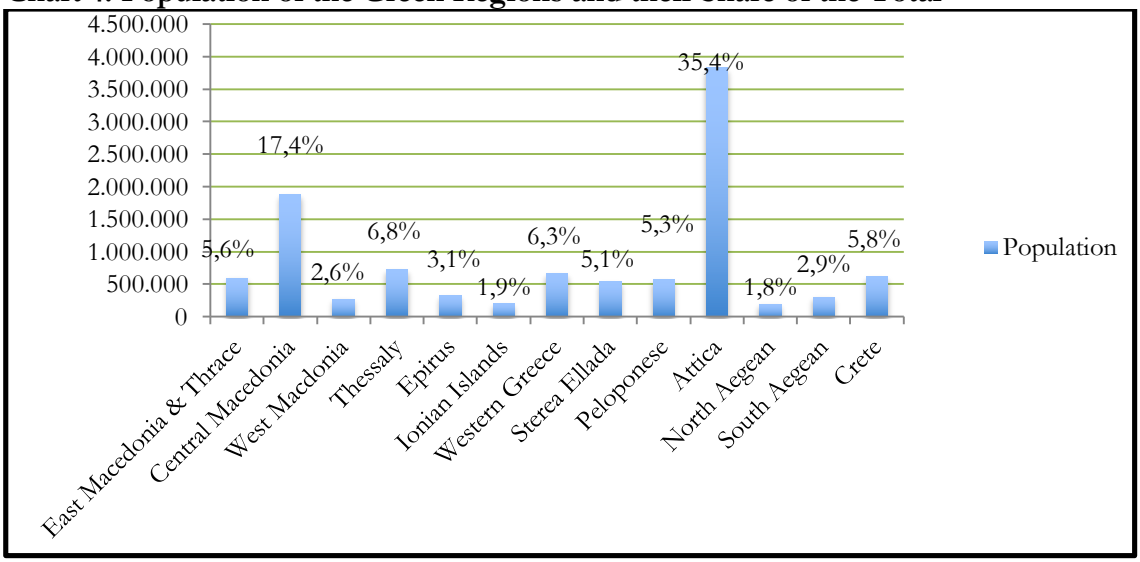
Table 16: Area and Population of the Regions under Study

	Area (Km²)	Population
Greece	131,997	10,816,286
Western Macedonia	9,451	283,689
Epirus	9,203	336,856
Western Greece	11,350	679,796
Total of the three regions	30,004	1,300,341
Percentage of the country's	23%	12%

Source: elaborated by the Author with data obtained (ELSTAT, 2015)

Their rank among the administrative regions of Greece is shown in the **Chart 4**. Western Greece is ranked forth, Epirus eighth and west Macedonia tenth.

Chart 4: Population of the Greek Regions and their Share of the Total



Source: (ELSTAT, 2015)

Furthermore, in those regions belong two of the ten bigger municipalities of the country Patras and Ioannina, 3rd and 10th respectively (see **Table 17**).

Table 17: Ten Bigger Municipalities of Greece

Cities	Population
Athens	664,046
Thessaloniki	325,182
Patras	213,984
Iraklion	173,993
Piraeus	163,688
Larisa	162,591
Volos	144,449
Peristeri	139,981
Rhodes	115,490
Ioannina	112,486

Source: (ELSTAT, 2015)

4.2 Gross Domestic Product

The Gross Domestic Product (GDP) of the three regions for the year 2012 summed up to 17,709 million €, a 9.1% of the GDP of the country. In the **Table 18**, the GDP of each region is presented as well as that of their prefectures.

Table 18: Gross Domestic Product by Region and Prefecture for 2000-2012
(million € current prices)

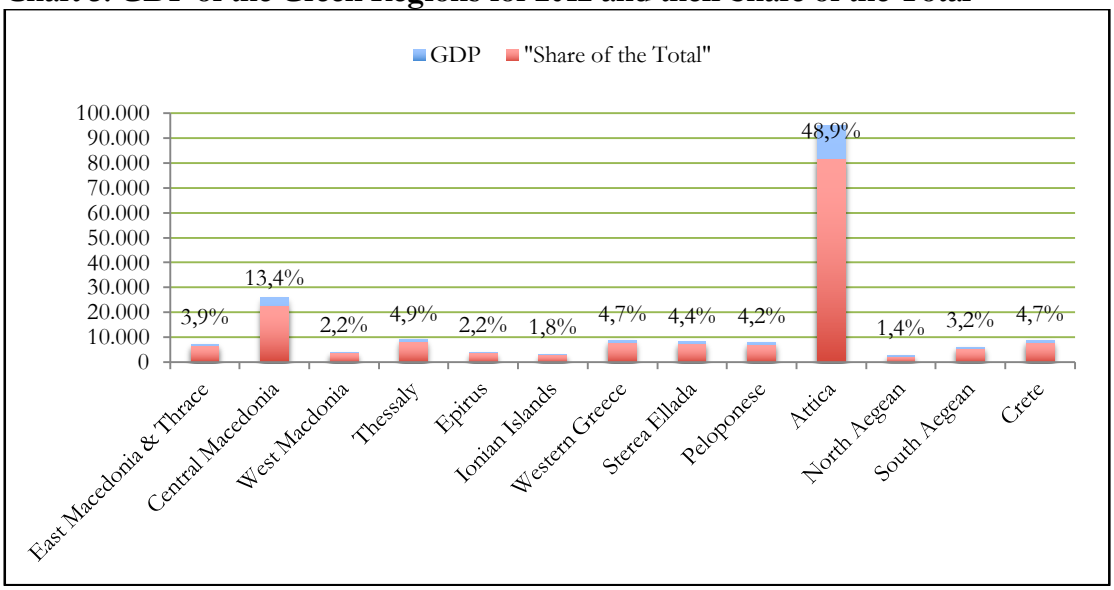
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Greece	**141,732**	**151,987**	**162,274**	**178,571**	**193,013**	**199,153**	**217,831**	**232,831**	**242,096**	**237,431**	**226,210**	**207,752**	**194,204**
West Macedonia	**3,259**	**3,526**	**3,875**	**4,265**	**4,611**	**4,735**	**5,149**	**5,433**	**5,490**	**5,540**	**5,038**	**4,583**	**4,304**
Grevena	283	301	304	312	353	353	365	384	405	373	384	359	350
Kastoria	411	450	489	537	540	561	608	651	679	668	636	615	581
Kozani	1,925	2,088	2,329	2,563	2,782	2,844	3,124	3,343	3,327	3,402	3,056	2,701	2,528
Florina	640	686	753	854	936	978	1,052	1,054	1,079	1,097	962	909	846
Epirus	**3,386**	**3,638**	**3,880**	**4,271**	**4,413**	**4,539**	**4,829**	**5,040**	**5,196**	**5,105**	**4,974**	**4,621**	**4,242**
Arta	594	634	714	786	777	830	889	903	916	934	930	841	778
Thesprotia	616	660	692	757	770	706	690	736	798	722	728	659	650
Ioannina	1,593	1,731	1,841	2,015	2,160	2,302	2,486	2,590	2,647	2,616	2,482	2,323	2,099
Preveza	583	613	634	713	706	702	763	811	835	833	834	797	716
Western Greece	**6,943**	**7,422**	**7,985**	**8,747**	**9,469**	**9,750**	**10,777**	**11,172**	**11,412**	**10,993**	**10,769**	**9,749**	**9,163**
Aitoloakarnania	1,944	2,097	2,238	2,462	2,762	2,858	3,078	3,065	3,205	3,178	3,001	2,720	2,586
Achaia	3,560	3,767	4,074	4,461	4,861	4,969	5,642	5,897	5,957	5,631	5,549	4,999	4,646
Ileia	1,439	1,558	1,673	1,824	1,846	1,924	2,057	2,210	2,250	2,184	2,219	2,030	1,931
Total Three Regions	**13,588**	**14,585**	**15,741**	**17,282**	**18,494**	**19,025**	**20,755**	**21,645**	**22,097**	**21,637**	**20,781**	**18,953**	**17,709**
Share of the Country's GDP	**9.6%**	**9.6%**	**9.7%**	**9.7%**	**9.6%**	**9.6%**	**9.5%**	**9.3%**	**9.1%**	**9.1%**	**9.2%**	**9.1%**	**9.1%**

*Provisional data Source: elaborated by the Author with data from (ELSTAT, 2012)

The dramatic drop of the GDP is apparent after 2008. The GDP of 2012 was almost equal to that of 2003. Bearing in mind that country was in recession for the years 2013 and 2014, the current GDP of the selected regions would be even lower. In the **Chart 5** the GDP of the Greek Regions is illustrated along with their share to the total of the country. Attica creates almost half GDP of the country. Central Macedonia (Thessalonica) and Thessaly follow in the second and third place respectively. No wonder, why those three regions have been chosen of "being first served" with natural gas.

Western Greece is ranked forth, but Epirus and West Macedonia are among the laggards of the country. Natural gas supply could help the development of regional economies. In the next section the economic activities if each region will be presented.

Chart 5: GDP of the Greek Regions for 2012 and their Share of the Total



Source: Elaborated by the Author with data from (ELSTAT, 2012)

Yet, it is very indicative the per capita GDP of the under study regions. After 2010 the per capita GDP reduced severely. Comparing regional per capita GDP with national, their percentage relationship has retreated to 2002 (see **Table 19**).

Table 19: Per Capita Gross Domestic Product by Region and Prefecture for 2000-2012 (in €, at current prices)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012*
Greece	**12,983**	**13,878**	**14,774**	**16,207**	**17,458**	**17,953**	**19,575**	**20,857**	**21,642**	**21,224**	**20,282**	**18,677**	**17,507**
West Macedonia	**11,103**	**12,039**	**13,236**	**14,570**	**15,762**	**16,209**	**17,663**	**18,669**	**18,913**	**19,171**	**17,553**	**16,006**	**15,050**
Grevena	8,706	9,290	9,412	9,684	10,990	10,985	11,401	12,048	12,753	11,780	12,142	11,162	10,633
Kastoria	7,716	8,554	9,313	10,241	10,327	10,759	11,710	12,584	13,147	12,983	12,454	12,121	11,527
Kozani	12,439	13,403	14,948	16,444	17,860	18,281	20,116	21,569	21,538	22,154	20,065	17,821	16,748
Florina	12,077	13,195	14,444	16,330	17,882	18,682	20,115	20,131	20,591	20,979	18,495	17,502	16,333
% of National	**86%**	**87%**	**90%**	**90%**	**90%**	**90%**	**90%**	**90%**	**87%**	**90%**	**87%**	**86%**	**86%**
Epirus	**9,932**	**10,525**	**11,228**	**12,348**	**12,749**	**13,105**	**13,929**	**14,512**	**14,936**	**14,672**	**14,325**	**13,307**	**12,207**
Arta	7,966	8,440	9,560	10,573	10,525	11,311	12,182	12,445	12,724	13,072	13,160	12,050	11,281
Thesprotia	14,199	15,216	15,880	17,324	17,546	16,029	15,614	16,594	17,941	16,195	16,312	14,640	14,288
Ioannina	9,657	10,228	10,868	11,869	12,695	13,504	14,553	15,087	15,349	15,125	14,349	13,424	12,121
Preveza	10,049	10,582	10,933	12,273	12,116	11,990	13,016	13,810	14,165	14,134	14,149	13,434	11,940
% of National	**76%**	**76%**	**76%**	**76%**	**73%**	**73%**	**71%**	**70%**	**69%**	**69%**	**71%**	**71%**	**70%**
Western Greece	**9,735**	**10,537**	**11,355**	**12,446**	**13,483**	**13,896**	**15,380**	**15,956**	**16,318**	**15,763**	**15,525**	**14,170**	**13,451**
Aitoloakarnania	8,777	9,427	10,087	11,118	12,504	12,971	14,015	14,002	14,702	14,657	13,939	12,746	12,243
Achaia	11,241	11,926	12,892	14,098	15,342	15,669	17,787	18,566	18,738	17,729	17,543	15,967	15,040
Ileia	8,223	9,385	10,120	11,061	11,218	11,716	12,552	13,502	13,769	13,404	13,693	12,567	11,988
% of National	**75%**	**76%**	**77%**	**77%**	**77%**	**77%**	**79%**	**76%**	**75%**	**74%**	**77%**	**76%**	**77%**

*Provisional data

Source: elaborated by the Author with data from (ELSTAT, 2012)

4.3 Regional Economies

As it has been discussed in the previous sections the economies of the three aforementioned regions fall far behind to the rest mainland regions. It is worth, however, having a depiction of the sectors that contribute to the local economies. In the **Table 20**, the sectors and specifically the activities that contribute to the regions' Gross Added Value (GAV) are given.

Table 20: Gross Added Value by Sector (A10)[2] and by Region for 2012
(million € at current prices)

Sectors / Regions	A	B,Γ,Δ, E	ΣΤ	Z,H,Θ	I	K	Λ	M,N	Ξ,Ο,Π	Ρ,Σ,Τ,Υ
Greece	**6,326**	**19,249**	**4,428**	**40,593**	**5,951**	**8,293**	**33,413**	**8,408**	**37,003**	**7,550**
West Macedonia	239	**1,142**	254	1,623	102	192	1,311	218	**2,267**	434
Epirus	278	363	160	835	59	91	646	110	**1,049**	148
Western Greece	735	754	303	1,848	212	207	1,398	243	**1,985**	395

*Provisional data Source: (ELSTAT, 2014)

Public sector (Ξ,Ο,Π) is dominant in all three of them. Commerce, transportation and tourism (Z,H,Θ) are following. They have a reverse position comparing with the whole country. Finally, real estate (Λ) is coming third as it is in the whole country. In West Macedonia, mines and electricity production contribute a significant part to GAV, since there is harboured almost all electricity production fuelled with lignite.

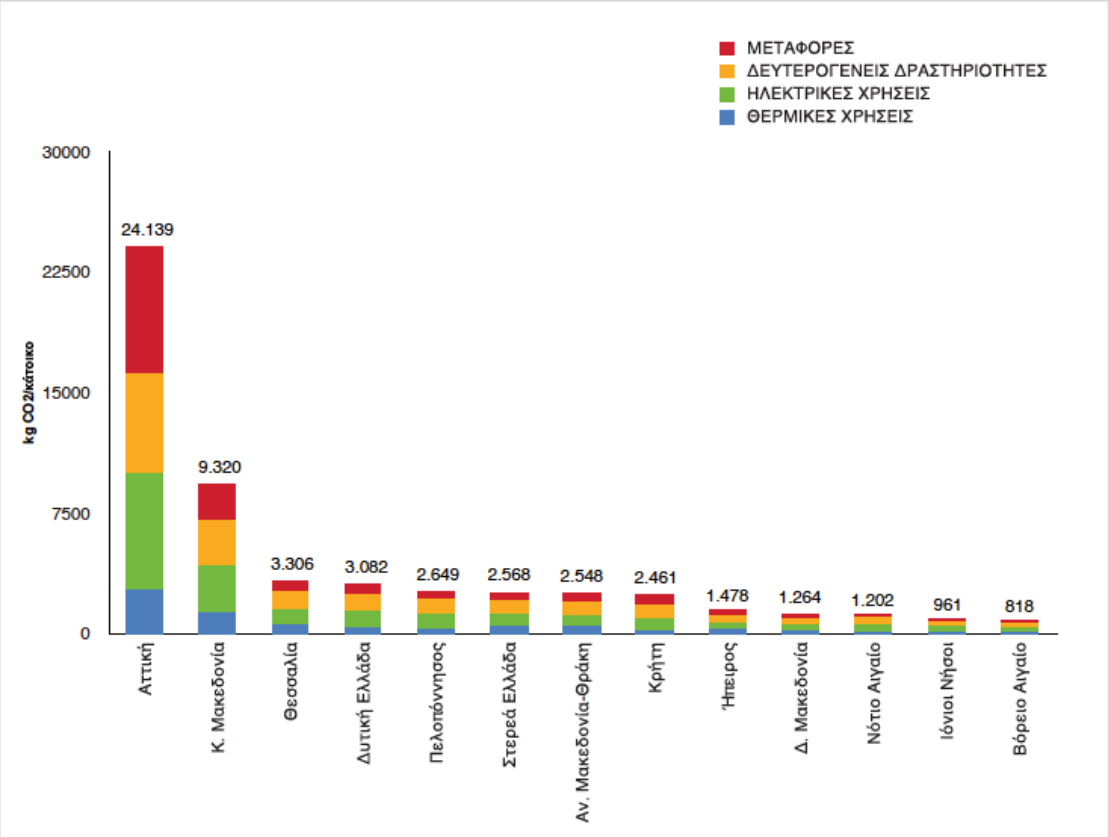
[2] List of sectors and activities

Description of the sectors of economic activities according to Nace Rev.2/ A10		
Α	Α	Agriculture, Forestry and Fishery
Β, Γ, Δ, Ε	Β	Mines and Fishery
	Γ	Processing
	Δ	Electricity, Natural Gas, Steam and Cooling supply
	Ε	Water and Sewage Utilities, Residues and Garbage Management, Sanitation
ΣΤ	ΣΤ	Constructions
Ζ, Η, Θ	Ζ	Commerce (Gross & Retail), Machinery Vehicle and Motorbikes Repairs
	Η	Transportation, Logistics
	Θ	Hotel and Restaurant
Ι	Ι	Broadcasting and Communications
Κ	Κ	Finance and Insurance
Λ	Λ	Real Estate
Μ, Ν	Μ	Professional, Scientific & Technical Activities
	Ν	Administrative & Supportive Activities
Ξ, Ο, Π	Ξ	Public Administration & Defense
	Ο	Education
	Π	Health and Human Care Activities
Ρ, Σ, Τ, Υ	Ρ	Arts, Recreation & Entertainment
	Σ	Other Services
	Τ	Households Productive Activities for Self Consumption
	Υ	Activities of Extraterritorial Organisations and Bodies

Source: Elaborated by the Author with data from (ELSTAT, 2014)

The footprint of energy spent of the Greek regions for various uses is shown in **Chart 6**. Western Greece is forth, but Epirus and West Macedonia have the lower footprint among the mainland regions due mainly to their economic development delay.

Chart 6: Energy Footprint of Greek Regions (kg CO_2/habitant)



Source: (Helesco A.E, 2011)

Red: Transportation
Orange: Secondary Sector Activities
Green: Electric Uses
Blue: Thermal Uses

Chapter 5: "Virtual" Natural Gas Pipelines in Greece

The lack of natural gas pipelines in the aforementioned regions generates disadvantages for the local economies. At the same time, it creates business opportunities for profitable and affordable energy supply.

5.1 Natural Gas Forms

The alternative solution to the construction of natural gas pipelines is the creation of "virtual pipelines". The latter is referred to the transportation by road, by rail or by sea of natural gas in Compressed (CNG) or Liquid (LNG) form. In this case, LNG solutions for long distance transportation (not with the meaning of a virtual DESFA) and CNG solutions for local distribution will be taken under consideration.

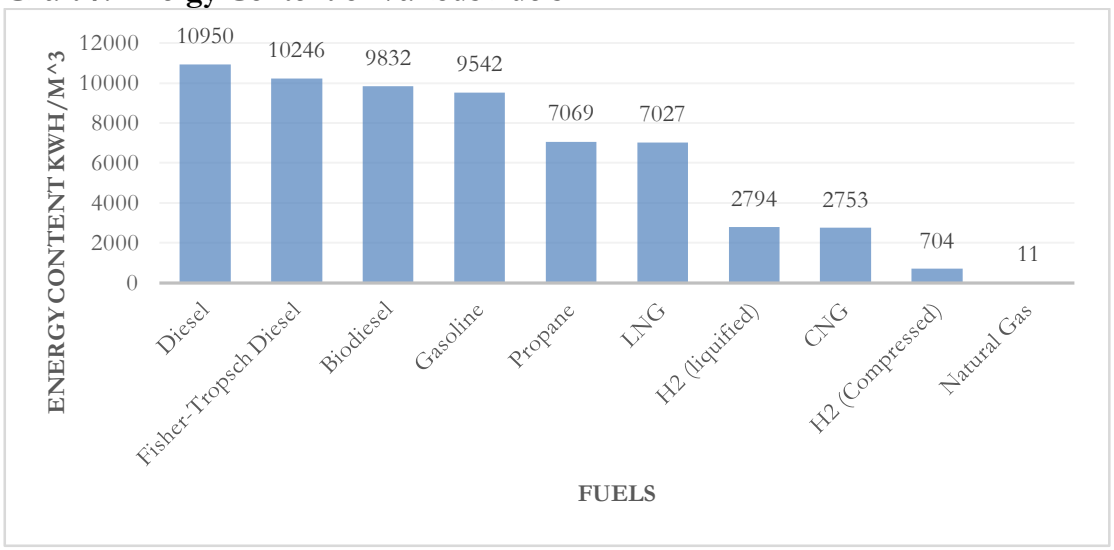
Table 21: Natural Gas Characteristics as Gas, CNG and LNG

	Pressure (bar)	Gross Calorific Value kWh/m³	Density Kg/m³	Temperature (ºC)
NG (pipelines)	1	11.16	0.79	0
CNG	>200 bar	2753	28	15
LNG	1	7027	430-478	-158

Source: Elaborated by the Author with data from (DESFA, 2007) (DEPA, 2014)

The characteristics of the three forms of natural gas are presented in the following **Table 21.** CNG and LNG are 246 and ~600 times, respectively, denser than natural gas. In the next **Chart 7** a comparison of energy density with other fuels is presented.

Chart 7: Energy Content of Various Fuels



Source: Elaborated by the Author

LNG is, almost, as dense as LPG (liquid petroleum gas). Consequently, it can be established a LNG distribution network which will supply end users natural gas in the convenient for them form.

5.2 "Virtual" Pipelines Network

DESFA has announced many times the construction of truck loading terminal on mainland shore across the island of Revithousa. Recently, DESFA's managing director, Konstantinos Xifaras, wrote an article in which revealed that the truck load station will be ready by the end of 2016 (Xifaras, 2015). Taking as valid the above announcement, the virtual pipelines would depart from **DESFA's installations at Agia Triada**.

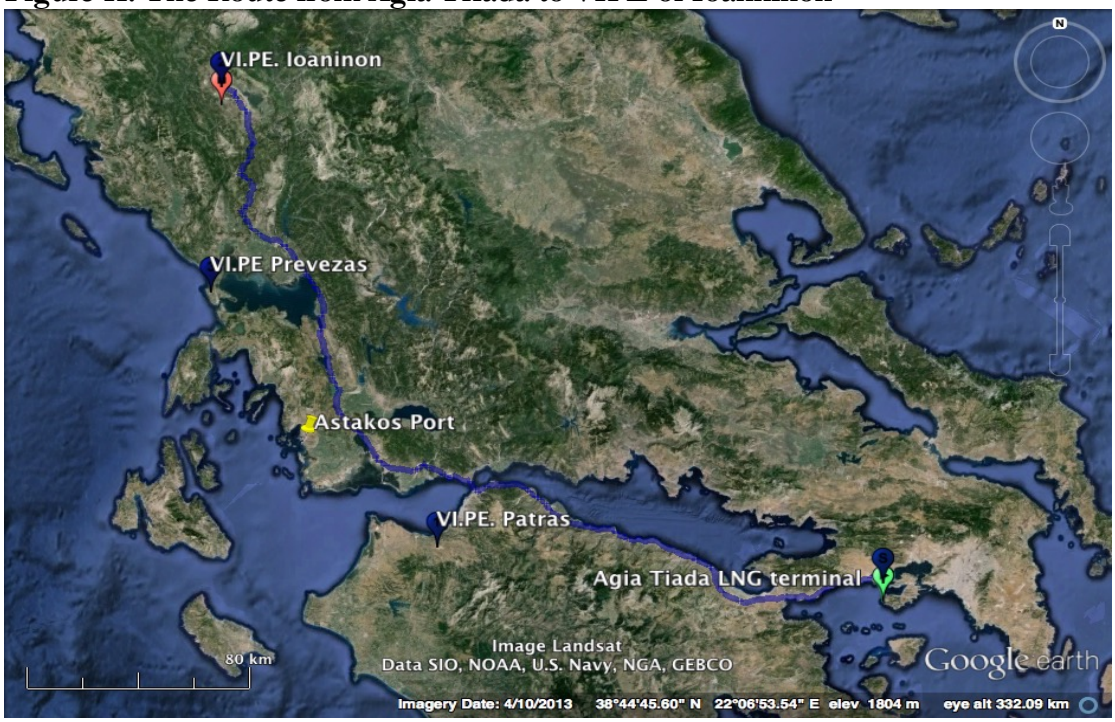
The destination of the "virtual" pipelines will be **industrial areas of Patras** and **Ioanninon,** VIPE Patras and Ionanninon, respectively. **Hence, trucks will be loaded with LNG at Agia Triada and will be unloaded at small regasification plants[3] at the two aforementioned VIPEs (see Figures 10 & 11)**. Alternatives for VIPE Ioannininon could be VIPE Prevezas or Astakos Port which are closer to Agia Triada.

Figure 10: The Route from Agia Triada to VIPE of Patras

[3] Should customers opt the LNG form, then they would be supplied directly with LNG

The VIPE Ioanninon was selected because: a) Ioannina is the 10th bigger city of Greece b) Prefecture of Ioannina is bordering West Macedonia, subsequently it can be there a distribution terminal for both regions of Epirus and West Macedonia.

Figure 11: The Route from Agia Triada to VIPE of Ioanninon



The choice of industrial zones as installation places of regasification plants was based on the following reasons: a) simpler environmental and installation licensing, b) avoidance of public reactions, c) favourable construction terms d) utilities' facilities e) **aggregated industrial customers.**

The distances of the VIPEs from Agia Triada and an approximate journey duration are given in the **Table 23.**

Table 22: Distance from Agia Triada and Journey Duration

	Distance from Agia Triada (Km)	Journey Duration
VIPE Ioanninon	400	5h 5min
VIPE Patras	205	2h 28min
Astakos Port	252	3h 18min
VIPE Prevezas	333	4h 17min

Source: Google Earth

The first step, consequently, of the plan is the transportation of LNG from DESFA's terminal to the regasification plants at the VIPEs.

5.3 Distribution

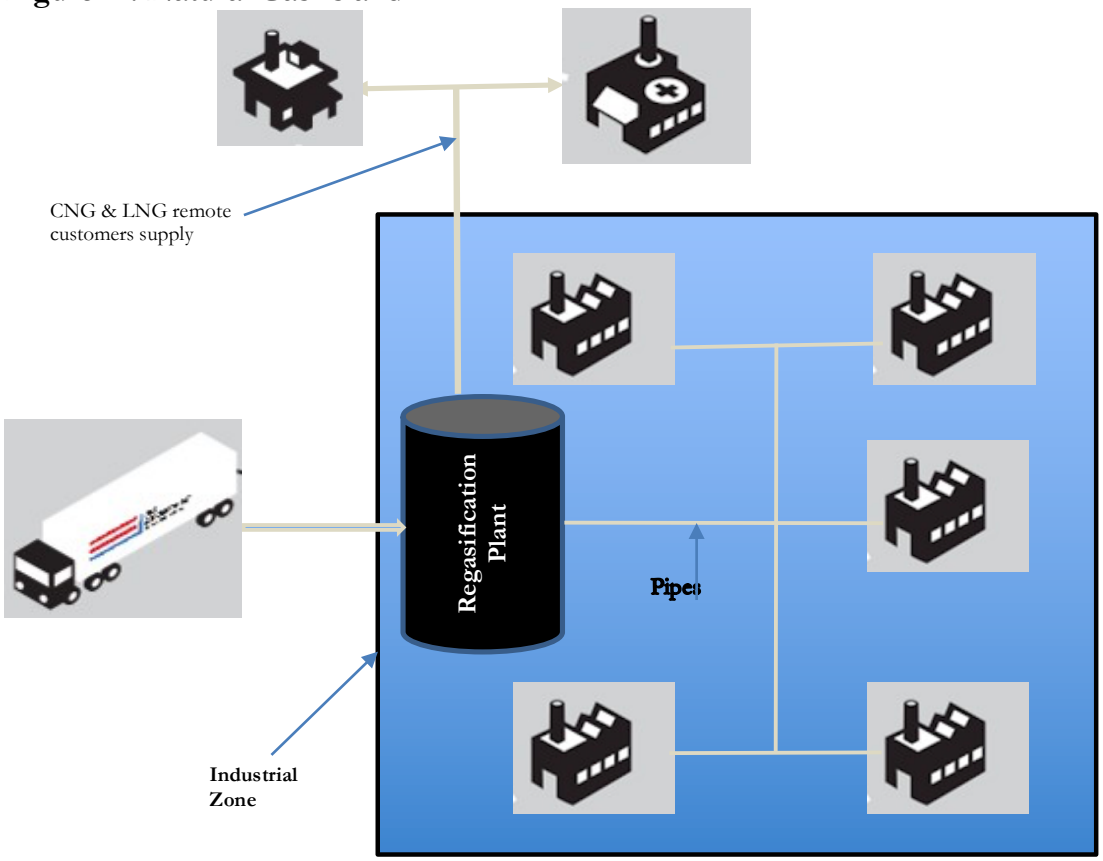
A small regasification plant will convert LNG to gaseous natural gas or CNG. Customers could opt the use of LNG, as well. In the VIPEs a pipeline network could be constructed which will distribute natural gas in all VIPE actual and future installed industries. The last could be possible after negotiations with the administrators of VIPEs, the ETBA-ΒΙ.ΠΕ. company, a subsidiary of Piraeus Bank.

There are two unsurpassed arguments for obtaining a contract:

a) natural gas will add attractiveness to VIPEs b) a fee should be offered to the ETVA from the profits.

Actually, a "natural gas island" will be constructed in each VIPE i.e. an autonomous small scale pipeline network comprised by physical and "virtual" parts which will supply natural gas in any form is convenient for its clients. Schematically, the concept is depicted in the following **Figure 12.**

Figure 12: Natural Gas Island



Source: Elaborated by the Author

Remote customers and car fuel stations would be supplied with CNG. In this case, large energy consumers such as industries, hotels hospitals and vehicle fleets operators would be contacted for switching to natural gas use. For example, urban transportation organisations of Patra and Ioannina could be potential natural gas consumers with substantial environmental and economic benefits for their cities and for them, respectively. **Figure 13** shows the surrounding territory of Patras' VIPE whilst the **Figure 14** depicts the area within the VIPE.

Figure 13: Surrounding Territory of VIPE Patras

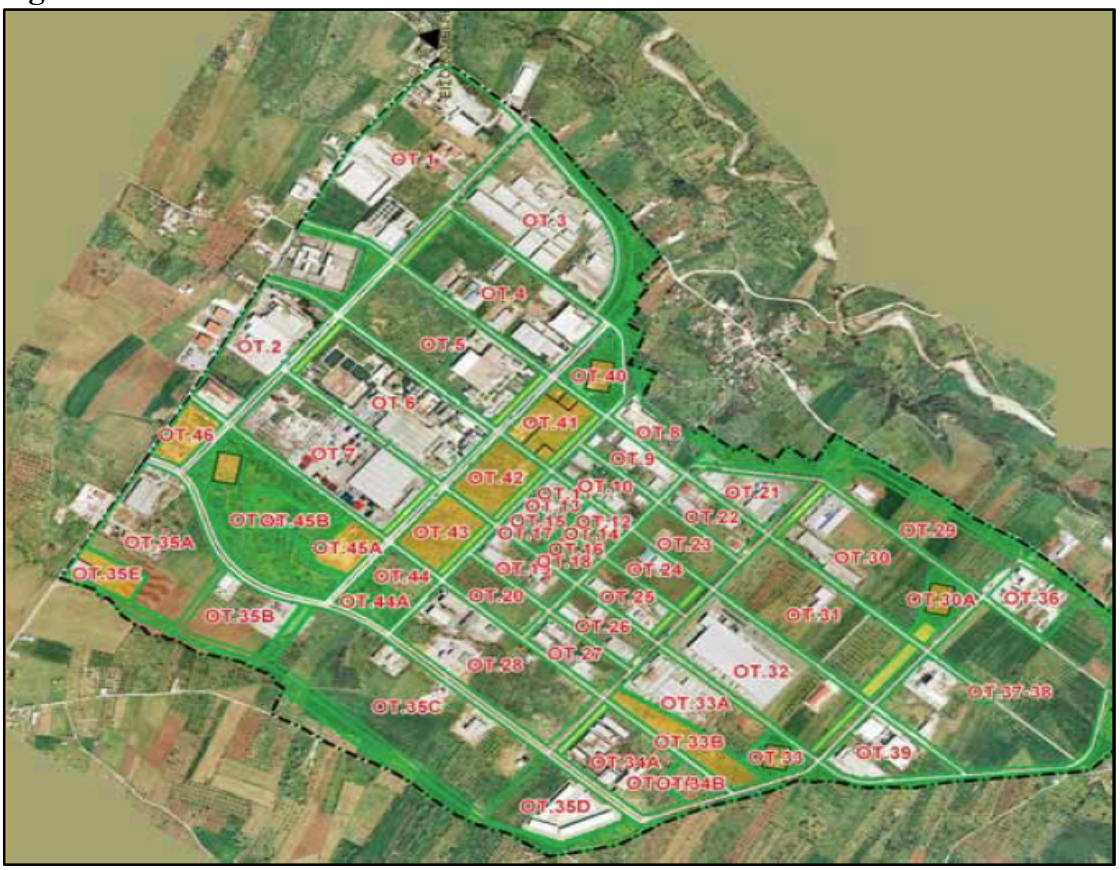
Source: (ETVA-VIPE, 2014)

Figure 14 and **15** are showing the surrounding area of VIPE Ioanninon and VIPE built-up plans, respectively (See **Appendix D** the VIPES' brochures and land's pricelist).

Other major services that can be offered in those areas are Energy Saving, Energy Efficiency and Management. Many companies are large energy consumers. Energy is an important factor of their production, but not a component of their core business. In that case, the trading company could act as Energy Services Company (ESCO) so that it would be possible to sale to its customer a full energy packet e.g. covering its energy needs, reliably, efficiently and economically. The business opportunities in this part of energy sector is enormous. Energy efficiency and combination of heat and power production, to refer only two, are activities with tremendous development potential in

Greece. Especially in West Greece where the economy needs an enhancement and increase of its competitiveness even against other parts of the country.

Figure 14: VIPE Patras Internal Street and Land-lots Plan



Source: (ETVA-VIPE, 2014)

ESCO's services can be used by all sectors, private and public whether the demand is for power reliability e.g. Banks, data base centres in Universities or companies or simply heat and cooling. They can offer an autonomy to the consumer as far as its peak demand is concerned. Yet, distributed forms of power production reduce energy loses of the transmission and distribution systems by being installed next to the consumption places. They minimise congestions and keep operating weak grids.

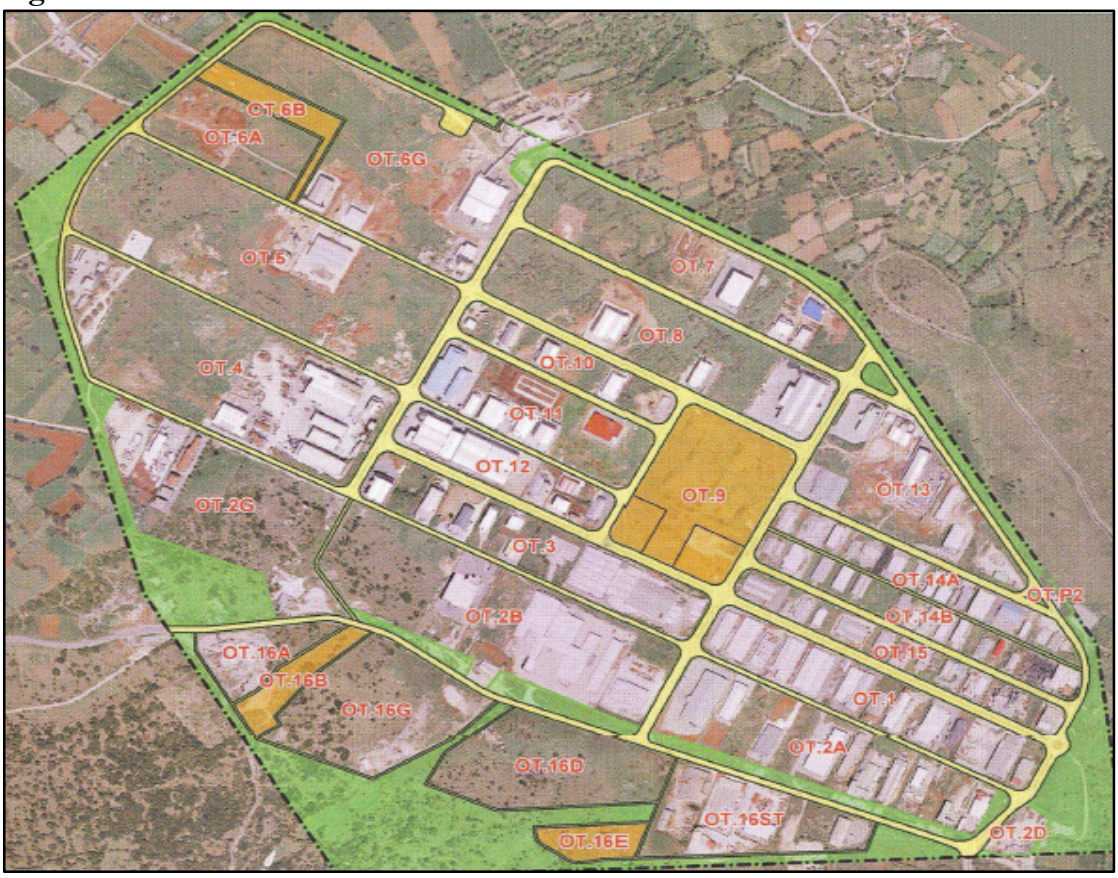
Last but not least, they postpone huge investments in wires and grid extensions and fortifications whether is used for transmission or distribution. and they can be combined with demand side management measures improving even more the electric power system. Undoubtedly, natural gas can be used with all known available technologies. It could be the opportunity fuel either for internal combustion engines or micro turbines and fuel cells. Innovative technologies such as heat pumps permit to consumers to enjoy heating and cooling efficiently by employing one installation.

Figure 15: Surrounding Territory of VIPE Patras

Source: (ETVA-VIPE, 2014)

All in all, LNG will be transported from DESFA's to small scale regasification plants in the VIPEs of Patras and Ioanninon. Natural gas will be distributed either by pipes within VIPES or in CNG form to remote consumers.

Figure 16: VIPE Patras Internal Street and Land-lot Plan



Source: (ETVA-VIPE, 2014)

Natural Gas trading company must supplement its activities with energy services i.e. being an ESCO entity as well. This will increase the range of the potential customers and revenues. At the same time, it should be an agent of innovative technologies and concepts so that natural gas will increase its share in the energy mix of the under consideration regions.

Chapter 6: Technology and Operation

The technology is the most important factor for the smooth and reliable operation of the "virtual" pipeline network. Small scale LNG installations have been deployed in many countries around the globe. It can be assumed safely that there is mature and reliable technology for projects of small scale LNG in Greece. For the purposes of this study four manufacturers were selected: a) the Spanish "Ros Roca Cryo Energy Indox" b) the Americans Chart c) Bauer and d) Verdek (See **Appendix E** for equipment information). However, in the following sections, equipment information of LNG as well of CNG applications will be presented because the author considers that both equipment are appropriate for supplying remote consumers.

The size of plant and distribution equipment will not be defined from the beginning. It is recommended a modular plant to be constructed on which could be added modules for increasing its capacity. Modular design improves business development flexibility and reduces high upfront capital investment.

6.1 Transportation and Storage

Transportation would be made with cryogenic semi-trailers truck mounded (see **Image 1 & 2**). Their capacity range from 40 to 60 tonnes Gross Weight, and approximately can carry 20 tonnes LNG in 3 to 7 bars pressure. The fleet will be adapted to the increasing natural gas demand.

Image 1: Truck mounded & semi trailers for LNG transportation

Source: (Chart, 2015)

Because they are extremely well insulated, they can be used as storage tank as well without any product loss. The trucks will make cyclical journey by carrying loaded trailers upstream and unfilled downstream.

Image 2: Semi Trailers Be Used as Storage Tanks

Source: (Chart, 2015)

In the future when possibly demand will exceed the capacity of the chosen storage equipment, stationary cryogenic storage tanks could be used. The stationary tanks could be in horizontal or vertical position. Their capacity can reach the 300m^3 (see **Appendix E** and **Image 3**).

Image 3: Stationary Storage LNG Tank

Source: (INDOX, 2015)

6.2 Regasification Plant

Regasification plant is the most important part of the equipment. It turns LNG in gaseous phase which then can be used through pipes or be compressed as CNG. Its construction should be modular i.e. plant's capacity will follow demand. The basic parts of the plant are: a) LNG storage, as was explained in the previous section cryogenic semi trailers can be used as storage tanks, b) load and unload systems c) the gasification unit d) control systems e) odorising system (add smell to natural gas) f) plant security system

Image 4: Small Scale LNG Regasification Plant

Source: (INDOX, 2015)

The **Image 4** shows a small LNG regasification plant. It is indicative of the technology available for small scale projects. However, the modular development of the plant is apparent. As demand may increase, the natural gas trader would add storage tanks and evaporators. This simplifies the financing of the project and eliminates the risk to be taken.

In the present case, two regasification plants will be installed in the VIPEs of Patras and Ioanninon. As it was explained, in the beginning of this chapter, should regions' demand increases disproportionally to the modular development capability of the planed plants, then new regasification installations could be added in the alternative VIPEs of Preveza and Astakos Port.

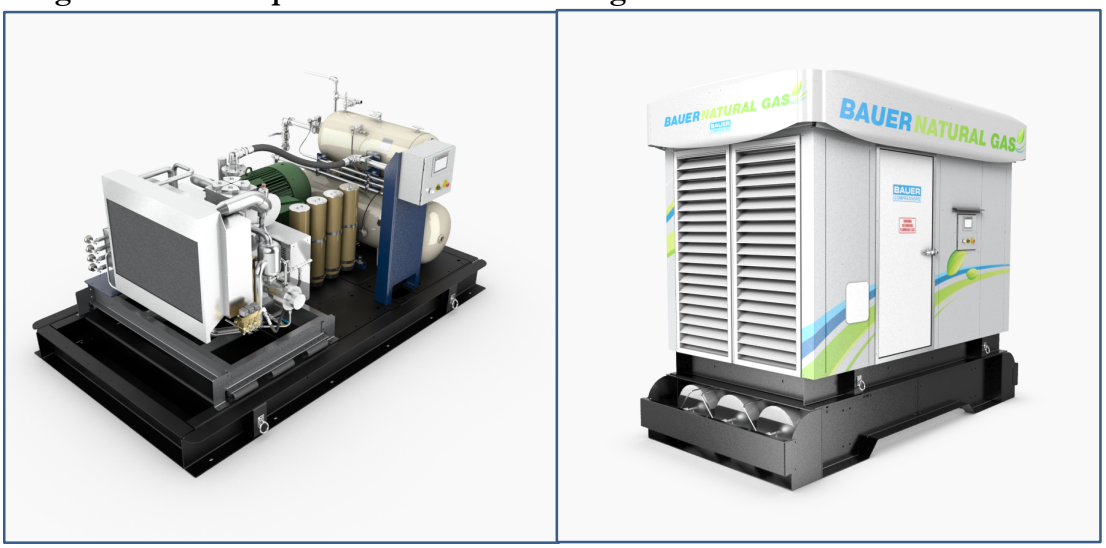
6.3 CNG Distribution and End Users Equipment

Remote customers could use natural gas in compressed or liquid form. Both need specialised equipment. As far as LNG is concerned, it can be transferred from storage tanks or trucks to small cryogenic vessels. These vessels could be installed at end-consumers' premises (see **Image 5**).

Image 5: LNG Microfueler and Refueling System from Chart Industries

On the other hand, for supplying compressed natural gas (CNG) trader should compress the gasified natural gas (see **Image 6**) and store it in particular CNG storage vessels.

Image 6: CNG Compressor-Inside & Housing

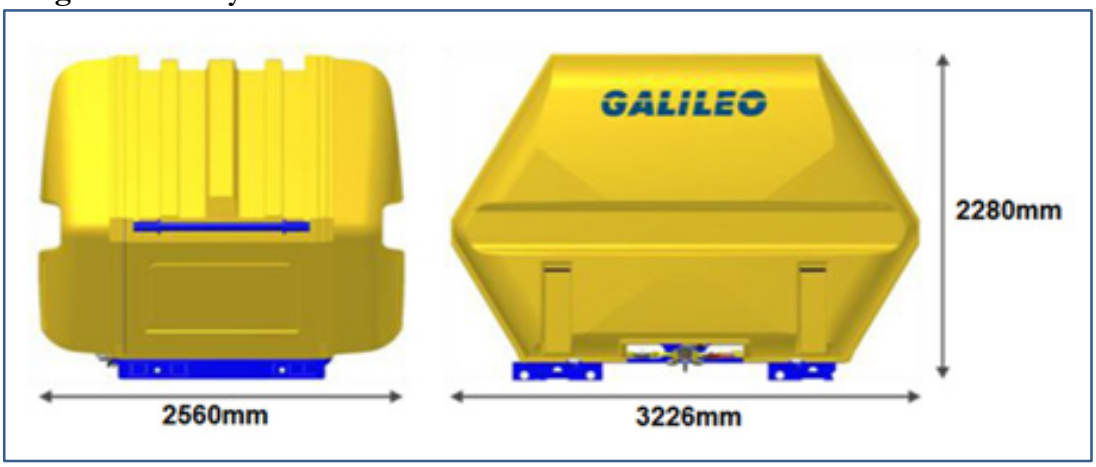


Source: (BAUER, 2015)

Transportation and storage of CNG is made with tanks under pressure. Normally, the pressure exceeds 200 bar. Because CNG distribution demands a well organised logistics system in the following lines the technology developed by VERDEK (VERDEK, 2015) company will be presented. This technology covers all the steps from compressor to end-user. Although it is indicative, it is very informative. Yet, it is modular as all the technologies presented in this chapter.

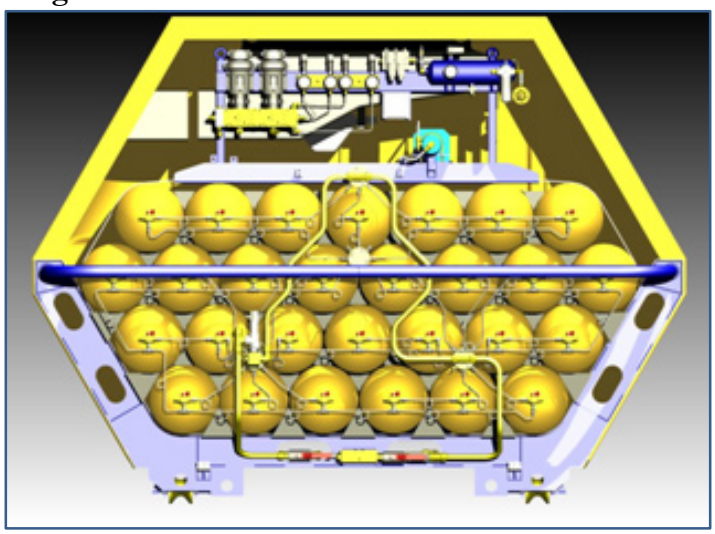
In the **Image 7** the modular CNG container. Inside the container, there are 39 cylinders for CNG storage.

Image 7: CNG Cylinders Container



It contains ~6 m^3 of CNG at ~245 bar. Another version of the aforementioned container, has 28 cylinders and a booster for better exploitation of CNG stored, up to 92% (see **Image 8**).

Image 8: CNG Container Inside-with Booster



Next, containers are loaded on a truck which transport them to the customers site. A truck can transport three containers (see **Image 9**).

Image 9: CNG Transportation by Truck

Finally, containers are mounded on hydraulic rumps on the customers' site (see **Image 10**). When the cylinders are empty truck take them for refilling, leaving new ones. Truck is making round trips i.e. becomes a "virtual" pipeline.

Image 10: CNG Containers at Customer's Site

As it has been said from the beginning the presented technologies are indicatives. There many companies that offer LNG and CNG equipment. Investigating further "virtual" pipelines, budget offers could be asked from the manufacturers so that a comparison of technical maturity and costs of the equipment could be possible.

Chapter 7: Conclusions and Future Actions

7.1 Conclusions

Western Greece, Epirus and West Macedonia are lagging behind in economic development from all mainland regions of the country. They lack natural gas pipelines network which will supply them with a cheap and clean fuel.

Natural gas is, globally, an opportunity fuel and its market is growing rapidly. Greece should introduce natural gas in all economic sectors either public or private. Especially, Greece should supply the lagging regions with natural helping them, in this way, to increase their economy competitiveness.

The pipelines network expansion plan of the state owned natural gas transmission system operator (DESFA) exclude the above regions for the near or the distant future. However, this weakness creates a business opportunity for energy traders. They can fill the gap using innovative natural gas trading concepts and technology.

There is reliable technology for the formation of a "virtual" pipelines network. Nonetheless, it would offer affordable and reliable energy to the above regions and in the future in other parts of country such as islands.

In this case, natural gas as LNG will be transported from Agia Triada to the VIPEs of Patras and Ioanninon where regasification plants will convert it back into the gaseous phase. Next, pipelines will distribute it in the VIPEs' area and trucks will transport it as CNG to remote consumers. Meanwhile, exists the possibility of supplying LNG costumers which need larger quantities of energy e.g. CHP plants. LNG and CNG technology is so reliable and mature that the technical viability of any project could be secured.

At this point, a second important business opportunity for the energy trader is presented. Energy supplier could perform as energy service company offering energy planning and management for companies which want to focus on their core business. Energy efficiency and energy shaving combine well with natural gas.

Finally, natural gas is versatile fuel and can be used from any technology in any economic sector.

7.2 Future Actions

"Virtual" pipelines network is a new concept and for that reason there are not companies competing for a share of the market. Established companies as well as "greenfield"

efforts could initiate an involvement in natural gas trading via "virtual" pipelines network.

Initially, a business body should be established, if not existed. It should apply for natural gas supply license to RAE. Afterwards, it should prepare a detailed business plan. An, in deep, investigation of all aspects of the commitment to be undertaken should include: a) technology inquiries, b) contact with manufacturers and budget offers collection c) field trips to VIPEs d) preparation of potential customers lists by type and sector e) watchdogging the natural market and its legal framework.

Finally, it should start immediately negotiations with VIPE administrators and Piraeus Bank for two reasons: a) land acquisition in the VIPES and b) the right-of-way for distribution pipelines network within the VIPEs' area.

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Appendix A.
List of applications to RAE

ΜΗΤΡΩΟ ΑΙΤΗΣΕΩΝ (ΕΝΗΜΕΡΩΣΗ 22/10/2014)				
ΑΙΤΗΣΕΙΣ ΠΟΥ ΥΠΟΒΛΗΘΗΚΑΝ ΠΡΙΝ ΤΗΝ ΕΚΔΟΣΗ ΤΟΥ ΚΑΝΟΝΙΣΜΟΥ ΑΔΕΙΩΝ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ				
Α.Α.	ΜΕΡΟΜΗΝΙΑ ΥΠΟΒΟΛΗ	ΑΡ. ΠΡΩΤΟΚΟΛΛΟΥ	ΑΙΤΩΝ	ΑΝΤΙΚΕΙΜΕΝΟ ΑΙΤΗΣΗΣ
1	1/8/2007	I-56148	ΠΡΟΜΗΘΕΑΣ GAS Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
2	10/8/2007	I-56951	EGL HELLAS AE	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
3	13/6/2008	I-73744	TRANS ADRIATIC PIPELINE AG (TAP AG)	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
4	22/12/2008	I-82459	EDISON ΕΛΛΑΣ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
5	23/7/2009	I-93718	ΕΝΙΜΕΞ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΕΜΠΟΡΙΑΣ, ΔΙΑΝΟΜΗΣ, ΚΑΙ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
6	30/7/2009	I-94160	SOUTH EAST GAS E.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
ΑΙΤΗΣΕΙΣ ΠΟΥ ΥΠΟΒΛΗΘΗΚΑΝ ΜΕΤΑ ΤΗΝ ΕΚΔΟΣΗ ΤΟΥ ΚΑΝΟΝΙΣΜΟΥ ΑΔΕΙΩΝ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ				
7	27/5/2010	I-113986	ΔΕΠΑ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
8	10/6/2010	I-115213	ΔΕΣΦΑ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΚΥΡΙΟΤΗΤΑΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΕΣΦΑ
9	16/6/2010	I-115626	ΠΡΟΜΗΘΕΑΣ GAS Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
10	24/6/2010	I-116245	EGL HELLAS A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
11	14/7/2010	I-117544	EGL HELLAS A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
12	19/7/2010	I-117877	TRANS ADRIATIC PIPELINE AG (TAP AG)	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
13	4/10/2010	I-122838	Μ και Μ Ανώνυμη Εταιρεία Φυσικού Αερίου	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
14	20/10/2010	I-124275	AEGEAN POWER A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
15	18/11/2010	I-126854	ENIMEX A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
16	17/12/2010	I-129307	GASTRADE A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
17	9/2/2011	I-132619	LNG ΒΟΡΕΙΑΣ ΕΛΛΑΔΑΣ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
18	28/2/2011	I-133670	EDISON ΕΛΛΑΣ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
19	14/6/2011	I-139463	LNG ΒΟΡΕΙΑΣ ΕΛΛΑΔΑΣ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
20	1/7/2011	I-140373	ENERGEAN OIL&GAS A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
21	31/8/2011	I-143197	TRANS ADRIATIC PIPELINE AG (TAP AG)	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
22	30/12/2011	I-148885	ΤΕΡΝΑ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
23	25/4/2012	I-155322	LNG ΒΟΡΕΙΑΣ ΕΛΛΑΔΑΣ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
24	3/8/2012	I-160497	LNG ΒΟΡΕΙΑΣ ΕΛΛΑΔΑΣ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
25	17/9/2012	I-162035	ΗΡΩΝ ΘΕΡΜΟΗΛΕΚΤΡΙΚΗ Α.Ε.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
26	2/5/2013	I-171258	GUNVOR INTERNATIONAL B.V.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
27	18/11/2013	I-177945	GREEK ENVIRONMENTAL & ENERGY NETWORK A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
28	12/12/2013	I-178820	GASELA GmbH	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
29	7/2/2014	I-180671	TRANS ADRIATIC PIPELINE AG (TAP AG)	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΑΝΕΞΑΡΤΗΤΟΥ ΣΥΣΤΗΜΑΤΟΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
30	24/7/2014	I-186361	EDIL ΤΕΧΝΙΚΗ ΒΙΟΜΗΧΑΝΙΚΗ ΑΤΕΒΕ	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
31	22/9/2014	I-188144	WATT AND VOLT A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ
32	29/9/2014	I-188337	GREENSTEEL-CEDALION COMMODITIES A.E.	ΧΟΡΗΓΗΣΗ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ

Source: (RAE, 2015)

Appendix B.
DEPA's Announcement for Licence Modification

« 1. ΠΕΡΙΛΗΨΗ ΤΗΣ ΑΙΤΟΥΜΕΝΗΣ ΤΡΟΠΟΠΟΙΗΣΗΣ ΑΔΕΙΑΣ ΠΡΟΜΗΘΕΙΑΣ (σύμφωνα με το άρθρο 15.2 του Κανονισμού Αδειών Φυσικού Αερίου)
Η ΔΕΠΑ είναι κάτοχος άδειας προμήθειας φυσικού αερίου και εξυπηρετεί καταναλωτές οι οποίοι βρίσκονται στα Συστήματα Μεταφοράς (σημεία εξόδου του ΕΣΦΑ) καθώς και στα Δίκτυα Διανομής, όπου υφίστανται. Υπάρχουν δυνητικοί καταναλωτές σε περιοχές εκτός Συστημάτων Μεταφοράς π.χ. Πελοπόννησος, Ήπειρος, Κρήτη καθώς και σε περιοχές όπου δεν καλύπτονται από τα υφιστάμενα δίκτυα διανομής. Για την κάλυψη των αναγκών των καταναλωτών αυτών, υπάρχει ώριμη τεχνολογία η οποία δίνει τη δυνατότητα προμήθειας φυσικού αερίου μέσω μεταφοράς του σε συμπιεσμένη (Compressed Natural Gas – CNG) ή υγροποιημένη (Liquified Natural Gas – LNG) μορφή με ειδικά για τον σκοπό αυτό μεταφορικά μέσα και εξοπλισμό. Η μέθοδος αυτή εφαρμόζεται με μεγάλη επιτυχία και σε ευρεία κλίμακα διεθνώς, ενώ η τεχνολογία που την υποστηρίζει εξελίσσεται συνεχώς. Οι καταναλωτές θα είναι ηλεκτροπαραγωγοί (σε μη διασυνδεδεμένα νησιά), βιομηχανίες, μεγάλοι εμπορικοί (π.χ. ξενοδοχεία), και μεγάλοι αστικοί (νοσοκομεία, στάδια, σχολεία κα). Επιπλέον, οι πελάτες μπορεί να βρίσκονται σε συγκεκριμένη γεωγραφική περιοχή μικρής ακτίνας, όπου είναι δυνατόν να διασυνδεθούν με μικρής έκτασης αυτόνομο δίκτυο διανομής.
Η ΔΕΠΑ ενδιαφέρεται να δραστηριοποιηθεί στην αγορά αυτή, ουσιαστικά να ανοίξει την αγορά, καθιστώντας ευχερέστερη την πρόσβαση των καταναλωτών στην προμήθεια φυσικού αερίου. Σταθμοί φόρτωσης CNG μπορούν να δημιουργηθούν σε σημεία του συστήματος μεταφοράς ή διανομής (κατά προτίμηση του δικτύου μέσης πίεσης). Ήδη υπάρχουν διαμορφωμένοι σταθμοί σε Αττική (Ανθούσα, Άνω Λιόσια) και Θεσσαλονίκη (Πυλαία). Για τη μεταφορά LNG δεν έχει ολοκληρωθεί ακόμα η απαραίτητη υποδομή, εκτιμάται όμως ότι σύντομα θα είναι διαθέσιμη, στον τερματικό σταθμό ΥΦΑ της Ρεβυθούσας. Για το λόγο αυτό, ενώ η Τεχνική Έκθεση (στην ενότητα 2 που ακολουθεί) αλλά και το αντικείμενο της αιτούμενης τροποποίησης της Άδειας Προμήθειας, αφορά στη χρήση και των δύο τεχνολογιών (CNG/LNG), στην παρούσα φάση τα στοιχεία που αναφέρονται στο επιχειρηματικό σχέδιο (που περιέχεται στην ενότητα 3) αφορούν μόνο στη μεταφορά CNG. Η περιγραφή των μεγεθών είναι ενδεικτική και μπορεί να μεταβληθεί σύμφωνα με την εκδήλωση ενδιαφέροντος των καταναλωτών.»

Source: (RAE, 2015)

Appendix C.
Retail Natural Gas Prices

EPA Thessalonikis & Thessalias

Source: (EPA Thessalias, 2015) (EPA Thessalonikis, 2015)

ΤΙΜΕΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ ΑΝΑΛΟΓΙΚΟ ΤΕΛΟΣ		T1	T2	T3	T3C	T3D	ΘΕΡΜΟΓΟΝΟΣ ΔΥΝΑΜΗ
		€/Kwh	€/Kwh	€/Kwh	€/Kwh	€/Kwh	kwh/Nm3
2014	ΙΑΝΟΥΑΡΙΟΣ	0,065679074	0,054373627	0,056008150	0,053207743	0,056008150	11,2789
	ΦΕΒΡΟΥΑΡΙΟΣ	0,066542078	0,055236631	0,056871154	0,054027596	0,056871154	11,2672
	ΜΑΡΤΙΟΣ	0,066280157	0,054974710	0,056609233	0,053778771	0,056609233	11,2708
	ΑΠΡΙΛΙΟΣ	0,059492313	0,048186866	0,049821389	0,047330320	0,049821389	11,3037
	ΜΑΙΟΣ	0,058621674	0,047316227	0,048950750	0,041608138	0,041608138	11,3386
	ΙΟΥΝΙΟΣ	0,060981180	0,049675733	0,051310256	0,043613718	0,043613718	11,3550
	ΙΟΥΛΙΟΣ	0,056277137	0,044971690	0,046606213	0,039615281	0,039615281	11,3565
	ΑΥΓΟΥΣΤΟΣ	0,056866522	0,045561075	0,047195598	0,040116258	0,040116258	11,3901
	ΣΕΠΤΕΜΒΡΙΟΣ	0,056623527	0,045318080	0,046952603	0,039909713	0,039909713	11,4083
	ΟΚΤΩΒΡΙΟΣ	0,057795752	0,046490305	0,048124828	0,045718587	0,048124828	11,4171
	ΝΟΕΜΒΡΙΟΣ	0,058421866	0,047116419	0,048750942	0,046313395	0,048750942	11,3753
	ΔΕΚΕΜΒΡΙΟΣ	0,058576485	0,047271038	0,048905561	0,046460283	0,048905561	11,3323
2015	ΙΑΝΟΥΑΡΙΟΣ	0,059915423	0,048609976	0,050244499	0,047732274	0,050244499	11,3336
	ΦΕΒΡΟΥΑΡΙΟΣ	0,061588911	0,050283464	0,051917987	0,049322088	0,051917987	11,3846
	ΜΑΡΤΙΟΣ	0,062245186	0,050939739	0,052574262	0,049945549	0,052574262	11,3869
	ΑΠΡΙΛΙΟΣ	0,061827859	0,050522412	0,052156935	0,049549088	0,052156935	11,4189
	ΜΑΙΟΣ	0,054759258	0,043453811	0,045088334	0,038325084	0,038325084	11,4174
	ΙΟΥΝΙΟΣ	0,053379418	0,042073971	0,043708494	0,037152220	0,037152220	11,4515
	ΙΟΥΛΙΟΣ	0,053357786	0,042052339	0,043686862	0,037133833	0,037133833	11,5405
	ΑΥΓΟΥΣΤΟΣ	0,052707026	0,041401579	0,043036102	0,036580687	0,036580687	11,5588
	ΣΕΠΤΕΜΒΡΙΟΣ	0,051995756	0,040690309	0,042324832	0,035976107	0,035976107	11,5243
	ΟΚΤΩΒΡΙΟΣ	0,050726576	0,039421129	0,041055652	0,039002869	0,041055652	11,4752

ΤΙΜΕΣ ΦΥΣΙΚΟΥ ΑΕΡΙΟΥ ΑΝΑΛΟΓΙΚΟ ΤΕΛΟΣ		T1	T2	T3	T3C	T3D	ΘΕΡΜΟΓΟΝΟΣ ΔΥΝΑΜΗ
		€/Kwh	€/Kwh	€/Kwh	€/Kwh	€/Kwh	kwh/Nm3
2014	ΙΑΝΟΥΑΡΙΟΣ	0,065229490	0,053735504	0,055397285	0,052627421	0,055397285	11,2774
	ΦΕΒΡΟΥΑΡΙΟΣ	0,066462516	0,054968530	0,056630311	0,053798795	0,056630311	11,2656
	ΜΑΡΤΙΟΣ	0,066370512	0,054876526	0,056538307	0,053711392	0,056538307	11,2713
	ΑΠΡΙΛΙΟΣ	0,059955828	0,048461842	0,050123623	0,047617442	0,050123623	11,3043
	ΜΑΙΟΣ	0,059175820	0,047681834	0,049343615	0,041942073	0,041942073	11,3362
	ΙΟΥΝΙΟΣ	0,061091856	0,049597870	0,051259651	0,043570703	0,043570703	11,3481
	ΙΟΥΛΙΟΣ	0,057525558	0,046031572	0,047693353	0,04053935	0,04053935	11,3568
	ΑΥΓΟΥΣΤΟΣ	0,058171292	0,046677306	0,048339087	0,041088224	0,041088224	11,3910
	ΣΕΠΤΕΜΒΡΙΟΣ	0,058009059	0,046515073	0,048176854	0,040950326	0,040950326	11,4032
	ΟΚΤΩΒΡΙΟΣ	0,059193723	0,047699737	0,049361518	0,046893442	0,049361518	11,4191
	ΝΟΕΜΒΡΙΟΣ	0,059639874	0,048145888	0,049807669	0,047317286	0,049807669	11,3823
	ΔΕΚΕΜΒΡΙΟΣ	0,060160743	0,048666757	0,050328538	0,047812111	0,050328538	11,3346
2015	ΙΑΝΟΥΑΡΙΟΣ	0,061652284	0,050158298	0,051820079	0,049229075	0,051820079	11,3284
	ΦΕΒΡΟΥΑΡΙΟΣ	0,062464031	0,050970045	0,052631826	0,050000235	0,052631826	11,3850
	ΜΑΡΤΙΟΣ	0,063242119	0,051748133	0,053409914	0,050739418	0,053409914	11,4065
	ΑΠΡΙΛΙΟΣ	0,062845346	0,05135136	0,053013141	0,050362484	0,053013141	11,4194
	ΜΑΙΟΣ	0,055726894	0,044232908	0,045894689	0,039010486	0,039010486	11,4172
	ΙΟΥΝΙΟΣ	0,054365686	0,042871700	0,044533481	0,037853459	0,037853459	11,4479
	ΙΟΥΛΙΟΣ	0,054415752	0,042921766	0,044583547	0,037896015	0,037896015	11,5681

EPA Attikis (Residential) source: (EPA Attikis, 2015)

ΤΙΜΟΛΟΓΙΑ ΟΙΚΙΑΚΟΥ ΤΟΜΕΑ ΟΙΚΙΑΚΟ ΤΙΜΟΛΟΓΙΟ-ΤΙΜΟΛΟΓΗΣΕΙΣ 2013-2014-2015			
Χρέωση ισχύος (1) (€/60 μέρες)	Μέχρι 5 m3/ώρα	6,36	
	Μέχρι 40 m^3/ώρα	11,43	
	Μέχρι 60 m^3/ώρα	20,32	
	Πάνω από 60 m^3/ώρα	33,01	
Χρέωση ενέργειας (2) (€/kWh)		**Τιμή**	**ΑΘΔ: Συντ. Μετατροπής (kWh/Nm^3)**
	Ιανουάριος 2013	0,07775	11,3273
	Φεβρουάριος 2013	0,07576	11,5732
	Μάρτιος 2013	0,07540	11,5262
	Απρίλιος 2013	0,07568	11,7170
	Μάϊος 2013	0,07063	11,4041
	Ιούνιος 2013	0,07076	11,6976
	Ιούλιος 2013	0,07133	11,3847
	Αύγουστος 2013	0,06909	11,4733
	Σεπτέμβριος 2013	0,06925	11,4847
	Οκτώβριος 2013	0,06818	11,6211
	Νοέμβριος 2013	0,06774	11,4681

Ιανουάριος 2014	0,07018	11,4558
Φεβρουάριος 2014	0,07081	11,5598
Μάρτιος 2014	0,07029	11,3821
Απρίλιος 2014	0,06620	11,5737
Μάιος 2014	0,06541	11,3822
Ιούνιος 2014	0,06617	11,8720
Ιούλιος 2014	0,06611	11,5745
Αύγουστος 2014	0,06682	11,8845
Σεπτέμβριος 2014	0,06800	11,7040
Οκτώβριος 2014	0,06911	11,5736
Νοέμβριος 2014	0,06933	11,5901
Δεκέμβριος 2014	0,06968	11,9631
Ιανουάριος 2015	0,06841	11,8202
Φεβρουάριος 2015	0,06603	11,8803
Μάρτιος 2015	0,06660	11,9062
Απρίλιος 2015	0,06934	11,7874
Μάιος 2015	0,06113	11,8114
Ιούνιος 2015	0,05946	11,4968
Ιούλιος 2015	0,05934	11,6136
Αύγουστος 2015	0,05845	11,6308
Σεπτέμβριος 2015	0,05747	11,6198
Οκτώβριος 2015	0,05632	11,4854

EPA Attikis (airconditioning)

ΤΙΜΟΛΟΓΙΑ ΟΙΚΙΑΚΟΥ ΤΟΜΕΑ – ΤΙΜΟΛΟΓΙΟ ΚΛΙΜΑΤΙΣΜΟΥ ΤΙΜΟΛΟΓΗΣΕΙΣ 2013-2014-2015			
Χρέωση Ισχύος (1) (€/60 ημέρες)	Μέχρι 5 m^3/ώρα	6,36	
	Μέχρι 40 m^3/ώρα	11,43	
	Μέχρι 60 m^3/ώρα	20,32	
	Πάνω από 60 m^3/ώρα	33,01	
Χρέωση ενέργειας (2) (€/kWh)		**Τιμή**	**Α.Θ.Δ. Συντ. Μετατροπής (kWh/Nm^3)**
	Ιανουάριος 2013	0,07094	11,3273
	Φεβρουάριος 2013	0,06896	11,5732
	Μάρτιος 2013	0,06859	11,5262
	Απρίλιος 2013	0,06887	11,7170
	Μάιος 2013	0,06382	11,4041
	Ιούνιος 2013	0,06394	11,6976
	Ιούλιος 2013	0,06452	11,3847
	Αύγουστος 2013	0,06227	11,4733
	Σεπτέμβριος 2013	0,06243	11,4847
	Νοέμβριος 2013	0,06093	11,4681
	Δεκέμβριος 2013	0,06056	11,3787
	Ιανουάριος 2014	0,06337	11,4558
	Φεβρουάριος 2014	0,06400	11,5598
	Μάρτιος 2014	0,06348	11,3821
	Απρίλιος 2014	0,05939	11,5737
	Μάιος 2014	0,05860	11,3822
	Ιούνιος 2014	0,05936	11,8720
	Ιούλιος 2014	0,05930	11,5745
	Αύγουστος 2014	0,06001	11,8845
	Σεπτέμβριος 2014	0,06119	11,7040
	Οκτώβριος 2014	0,06230	11,5736
	Νοέμβριος 2014	0,06252	11,5901
	Δεκέμβριος 2014	0,06287	11,9631
	Ιανουάριος 2015	0,05933	11,8202
	Φεβρουάριος 2015	0,05695	11,8803
	Μάρτιος 2015	0,05752	11,9062
	Απρίλιος 2015	0,06026	11,7874
	Μάιος 2015	0,05205	11,8114
	Ιούνιος 2015	0,05039	11,4968
	Ιούλιος 2015	0,05026	11,6136
	Αύγουστος 2015	0,04938	11,6308
	Σεπτέμβριος 2015	0,04838	11,6198
	Οκτώβριος 2015	0,04724	11,4854

Appendix D
Industrial Zones Facilities and Land Prices

ΒΙ.ΠΕ. Πάτρας

Η ΒΙ.ΠΕ. Πάτρας είναι μια από τις 29 οργανωμένες βιομηχανικές περιοχές, που διαχειρίζεται η ΕΤΒΑ ΒΙ.ΠΕ. σε όλη την Ελλάδα.

Ενημερωθείτε για τις υποδομές και τις εξυπηρετήσεις που σας παρέχονται και αξιοποιήστε τα προνομιακά πλεονεκτήματα, που σας προσφέρει η ΕΤΒΑ ΒΙ.ΠΕ.

Πρόσθετα πλεονεκτήματα επενδυτών

- Καθαροί τίτλοι ακινήτων.
- Απαλλαγή από διαδικασία έκδοσης άδειας εγκατάστασης (ν. 2516/97 άρθρο 7 παρ. 5).
- Ευνοϊκοί όροι δόμησης
- Απαλλαγή απο Α στάδιο περιβαλλοντικής αδειοδότησης.
- Ειδικές προβλέψεις στα κίνητρα ιδιωτικών επενδύσεων (ν. 3299/04). Η ΒΙ.ΠΕ. ανήκει στην Περιοχή Γ.
- Ανάπτυξη συνεργιών εγκατεστημένων επιχειρήσεων

Όροι Δόμησης: (576Δ/11.6.2003 και 267/ΑΑΠ/2-7-2008).

Βιοτεχνικά / Βιομηχανικά Οικόπεδα

- Ελάχιστο πρόσωπο: εικοσιπέντε (25) μέτρα.
- Ελάχιστο εμβαδόν: δύο χιλιάδες (2000) τ.μ.
- Μέγιστο ποσοστό κάλυψης: 40% της επιφάνειας του οικοπέδου.
- Συντελεστής δόμησης: ένα και έξι δέκατα (1,6).
- Μέγιστο ύψος κτιρίων: εικοσιδύο (22) μέτρα.

ΥΠΟΔΟΜΕΣ

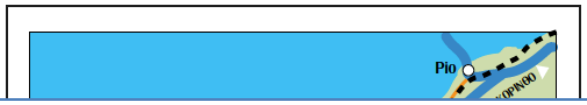
● Εσωτερικό οδικό δίκτυο ● Δίκτυο ύδρευσης ● Δίκτυο αποχέτευσης ομβρίων ● Δίκτυο αποχέτευσης ακαθάρτων ● Κεντρική μονάδα καθαρισμού αποβλήτων ● Ηλεκτροφωτισμός οδών ● Ηλεκτροδότηση ● Τηλεφωνοδότηση.

ΕΞΥΠΗΡΕΤΗΣΕΙΣ

● Γραφείο Διοίκησης - Διαχείρισης ΒΙ.ΠΕ. ● Πυροσβεστική Υπηρεσία.

ΣΥΓΚΟΙΝΩΝΙΑΚΟ ΔΙΚΤΥΟ

● Εθνικό οδικό δίκτυο ● Σύνδεση με λεωφορειακή γραμμή ● Λιμενική εξυπηρέτηση.



ΒΙ.ΠΕ. Ιωαννίνων

Η ΒΙ.ΠΕ. Ιωαννίνων είναι μια από τις 30 οργανωμένες βιομηχανικές περιοχές, που διαχειρίζεται η ΕΤΒΑ ΒΙ.ΠΕ. σε όλη την Ελλάδα.

Ενημερωθείτε για τις υποδομές και τις εξυπηρετήσεις που σας παρέχονται και αξιοποιήστε τα προνομιακά πλεονεκτήματα, που σας προσφέρει η ΕΤΒΑ ΒΙ.ΠΕ.

Πρόσθετα πλεονεκτήματα επενδυτών

- Καθαροί τίτλοι ακινήτων.
- Απαλλαγή από διαδικασία έκδοσης άδειας εγκατάστασης (ν. 2516/97 άρθρο 7 παρ. 5).
- Ευνοϊκοί όροι δόμησης
- Απαλλαγή απο Α στάδιο περιβαλλοντικής αδειοδότησης.
- Ειδικές προβλέψεις στα κίνητρα ιδιωτικών επενδύσεων (ν. 3299/04).
- Ανάπτυξη συνεργιών εγκατεστημένων επιχειρήσεων

Όροι Δόμησης: (ΦΕΚ 60Δ/17.2.1986, ΦΕΚ 1187Δ/27.9.1993 και ΦΕΚ 29ΑΑΠ/3.10.2006)

Βιοτεχνικά Οικόπεδα

- Ελάχιστο πρόσωπο: είκοσι (20) μέτρα.
- Ελάχιστο εμβαδόν: χίλια (1000) τ.μ.
- Μέγιστο ποσοστό κάλυψης: 60% της επιφάνειας του οικοπέδου.
- Συντελεστής δόμησης: ένα και έξι δέκατα (1,6).
- Μέγιστο ύψος κτιρίων: είκοσι (20) μέτρα.

Βιομηχανικά Οικόπεδα

- Ελάχιστο πρόσωπο: τριάντα (30) μέτρα.
- Ελάχιστο εμβαδόν: δύο χιλιάδες (2000) τ.μ.
- Μέγιστο ποσοστό κάλυψης: 60% της επιφάνειας του οικοπέδου.
- Συντελεστής δόμησης: ένα και έξι δέκατα (1,6).
- Μέγιστο ύψος κτιρίων: είκοσι τέσσερα (24) μέτρα.

ΥΠΟΔΟΜΕΣ

● Εσωτερικό οδικό δίκτυο ● Δίκτυο ύδρευσης ● Δίκτυο αποχέτευσης ομβρίων ● Δίκτυο αποχέτευσης ακαθάρτων ● Ηλεκτροδότηση ● Τηλεφωνοδότηση ● Φωτισμός οδών ● Φύλαξη.

ΕΞΥΠΗΡΕΤΗΣΕΙΣ

● Γραφείο Διοίκησης - Διαχείρισης ΒΙ.ΠΕ. ● Πυροσβεστικός Σταθμός.

ΣΥΓΚΟΙΝΩΝΙΑΚΟ ΔΙΚΤΥΟ

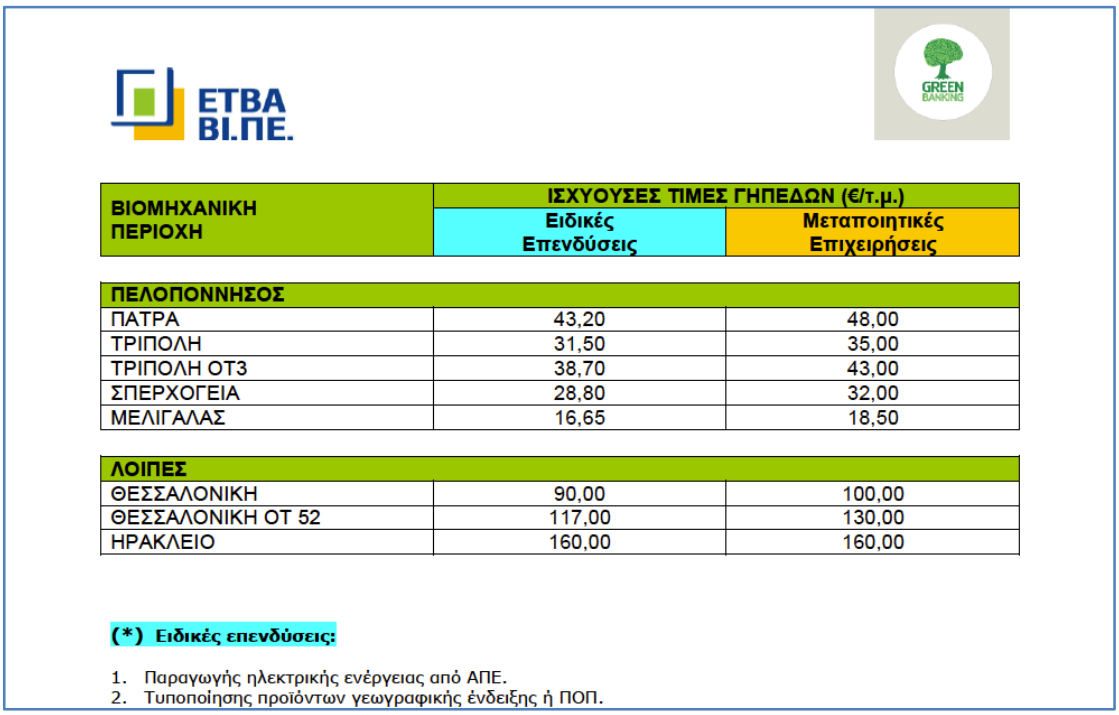
● Εθνικό οδικό δίκτυο ● Αεροπορική σύνδεση ● Σύνδεση με λεωφορειακή γραμμή.

ΕΤΒΑ ΒΙ.ΠΕ.

GREEN BANKING

ΤΙΜΟΛΟΓΙΑΚΗ ΠΟΛΙΤΙΚΗ ΕΩΣ 31.12.2014
(ΑΠΟΦΑΣΗ Δ.Σ. 164/29-5-2014)

ΒΙΟΜΗΧΑΝΙΚΗ ΠΕΡΙΟΧΗ	ΙΣΧΥΟΥΣΕΣ ΤΙΜΕΣ ΓΗΠΕΔΩΝ (€/τ.μ.)	
	Ειδικές Επενδύσεις	Μεταποιητικές Επιχειρήσεις
ΘΡΑΚΗ		
ΑΛΕΞΑΝΔΡΟΥΠΟΛΗ	24,75	27,50
ΚΟΜΟΤΗΝΗ	17,10	19,00
ΚΟΜΟΤΗΝΗ ΟΤ 9, ΟΤ14	16,20	18,00
ΞΑΝΘΗ	18,90	21,00
ΞΑΝΘΗ 10, 11, 12, 15, 18, 19	18,00	20,00
ΟΡΕΣΤΙΑΔΑ	24,00	25,00
ΣΑΠΠΕΣ	16,20	18,00
ΑΝΑΤΟΛΙΚΗ ΜΑΚΕΔΟΝΙΑ		
ΚΑΒΑΛΑ Α ΦΑΣΗ	18,90	21,00
ΚΑΒΑΛΑ Β ΦΑΣΗ	15,75	17,50
ΔΡΑΜΑ Α ΦΑΣΗ	18,00	20,00
ΔΡΑΜΑ Β ΦΑΣΗ	14,40	16,00
ΚΕΝΤΡΙΚΗ ΜΑΚΕΔΟΝΙΑ		
ΣΕΡΡΕΣ	18,00	20,00
ΚΙΛΚΙΣ	24,30	27,00
ΕΔΕΣΣΑ	12,60	14,00
ΔΥΤΙΚΗ ΜΑΚΕΔΟΝΙΑ		
ΦΛΩΡΙΝΑ Α ΦΑΣΗ	11,70	13,00
ΦΛΩΡΙΝΑ Β ΦΑΣΗ	9,90	11,00
ΚΑΣΤΟΡΙΑ	16,20	18,00
ΗΠΕΙΡΟΣ		
ΙΩΑΝΝΙΝΑ	22,50	25,00
ΠΡΕΒΕΖΑ	22,50	25,00
ΘΕΣΣΑΛΙΑ		
ΛΑΡΙΣΑ Α ΦΑΣΗ	24,30	27,00
ΛΑΡΙΣΑ Β ΦΑΣΗ	18,00	20,00
ΛΑΡΙΣΑ ΟΤ12	32,85	36,50
ΒΟΛΟΣ (ΚΥΡΙΑ)	27,00	30,00
ΒΟΛΟΣ (ΠΑΡΑΡΤΗΜΑ)	22,50	25,00
ΒΟΛΟΣ (ΒΙΟΠΑ)	27,00	30,00
ΒΟΛΟΣ (ΒΙΟΠΑ) ΟΤ2	32,40	36,00
ΒΟΛΟΣ (ΒΙΟΠΑ) ΟΤ15	32,40	36,00
ΚΑΡΔΙΤΣΑ	15,30	17,00
ΣΤΕΡΕΑ ΕΛΛΑΔΑ		
ΛΑΜΙΑ	32,40	36,00
ΑΜΦΙΣΣΑ	31,50	31,50



ΒΙΟΜΗΧΑΝΙΚΗ ΠΕΡΙΟΧΗ	ΙΣΧΥΟΥΣΕΣ ΤΙΜΕΣ ΓΗΠΕΔΩΝ (€/τ.μ.)	
	Ειδικές Επενδύσεις	Μεταποιητικές Επιχειρήσεις
ΠΕΛΟΠΟΝΝΗΣΟΣ		
ΠΑΤΡΑ	43,20	48,00
ΤΡΙΠΟΛΗ	31,50	35,00
ΤΡΙΠΟΛΗ ΟΤ3	38,70	43,00
ΣΠΕΡΧΟΓΕΙΑ	28,80	32,00
ΜΕΛΙΓΑΛΑΣ	16,65	18,50
ΛΟΙΠΕΣ		
ΘΕΣΣΑΛΟΝΙΚΗ	90,00	100,00
ΘΕΣΣΑΛΟΝΙΚΗ ΟΤ 52	117,00	130,00
ΗΡΑΚΛΕΙΟ	160,00	160,00

(*) Ειδικές επενδύσεις:

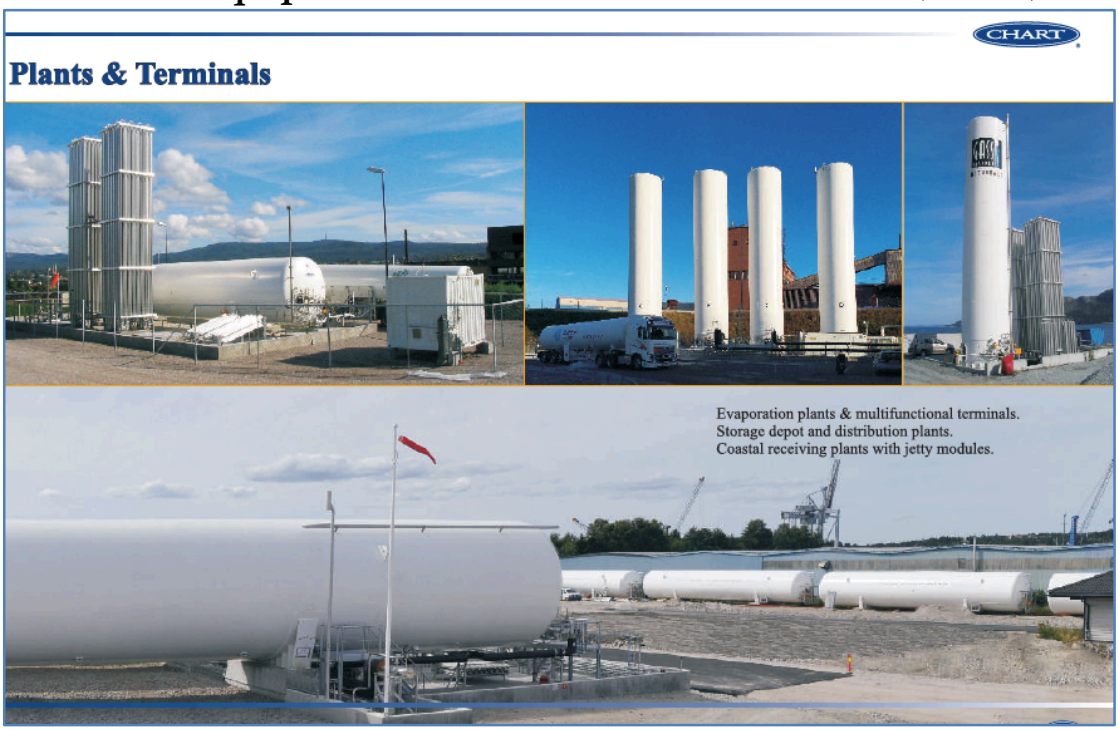
1. Παραγωγής ηλεκτρικής ενέργειας από ΑΠΕ.
2. Τυποποίησης προϊόντων γεωγραφικής ένδειξης ή ΠΟΠ.

Source: (ETVA-VIPE, 2014)

Appendix E
Equipment Information

CHART's Equipment

Source: (Chart, 2015)



LNG Semi Trailers & Truck-mounted

Optimized solutions for all traffic systems with Gross Weight (GCW) from 40 to 60 tons.
Characterized by a high quality, excellent finishing and reliability.
Super insulation provides secure storage for extended periods without product loss.
Customized solutions are our speciality.
Optional equipment includes electric or hydraulic pumps.

GOFA
A Chart Industries Company

The best payload and lifetime.

LNG MicroBulk Distribution

The technology includes tanker „ORCA“ and liquid cylinders „Perma-Cyl“.

ORCA is a fast filling cryogenic tanker with ADR and EN 13 530 compliance.
Submerged pump eliminates cool down losses and reduces delivery time.

Perma-Cyl LNG and Perma-Cyl HW LNG are superior stationary liquid cylinders.
Standard product features include:
- Capacity from 600 to 3000 liters for MicroBulk
- Pressures up to 24 bar
- Novel top fill float system for single hose filling without losing product
- Super insulated permanent vacuum system provides days of holding time without losing product through boil off

High quality workmanship and finish with excellent reliability.

LNG with MicroBulk to your householders and workshops.

System Fill-on-Site Technology

MICROBULK SOLUTIONS

Flow meter
LNG Dynaflow 3000
with MID approval

LNG MicroBulk System is the most economical LNG delivery system on the market.