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European Union energy supply security: The benefits of natural gas imports from the Eastern Mediterranean

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ABSTRACT

This paper analyzes the potential of Eastern Mediterranean offshore natural gas discoveries to increase EU natural gas supply security. It presents an overview of, the status quo of EU-28 natural gas import dependency, the efforts to increase energy security through various measures, and the challenges to supply diversification. It further provides an analysis of the energy and offshore resource sectors of Egypt, Israel, Cyprus and Lebanon. The paper presents projections of domestic natural gas consumption needs for the years 2012–2042 and results show that potentially large quantities will be available for exports. An empirical model is used to analyze the capital and transmission costs for exporting gas to Europe via the East Med pipeline. The East Med pipeline project is discussed in the broader context of other regional supply options as well as potential U.S. LNG exports to Europe. The paper concludes that the East Med pipeline, which has been classified as a project of Common Interest by the EU, should receive policy priority as its benefits in terms of security of supply go beyond those that can be captured in a competitive market, and the positive externalities that it provides justify a 'security premium'.

1. Introduction

Over the past decade worldwide recoverable reserves of natural gas have substantially increased and are currently estimated at around 6600 Trillion Cubic Feet (Tcf) or 187.1 Trillion Cubic Meters (Tcm). New discoveries of conventional and unconventional gas resources are scattered around the globe (see Fig. 1) leading to changes in market structure and questioning once more the doomsday rhetoric of Hubbert's peak oil/gas theory (Helm, 2014). The US, a major player on world gas markets, has transitioned from net importer to net exporter, removing market tensions that still existed just a few years ago. Slow global economic growth in recent years has weakened energy demand, growing at just 1% in 2015 (BP, 2016). The increased supply in combination with relatively low global demand for gas has led to lower prices, that if persistent, will eventually have its effects on supply (BP, 2016). Despite these developments, the major gas markets, North America, Europe and Asia remain more regional than for example the oil market and hence geopolitical considerations continue to play an important role.

The European Union's yearly natural gas consumption amounts to roughly 16 million TJ (Eurostat, 2014). Over the period 2010–2050 the EU-28's Total Primary Energy Supply (TPES) and production are expected to decrease while the share of natural gas in TPES stays constant at approximately 24–25% (EC, 2016a). Despite the steadily decreasing consumption levels, the decrease in primary energy production will exceed the decrease in consumption, mainly because of declining domestic reserves and the low probability of Europe significantly developing its unconventional resources (EC, 2016a). Natural gas import dependency in 2015 stands at 73%, corresponding to 317 Bcm and is projected to increase to 80% or more by 2035 (EC, 2014; Wood, 2016). In 2015 piped gas imports amounting to roughly 85% of total gas imports, originate from four countries with Russia accounting for 42% of these imports (Table 1). LNG accounts for 15% of total gas imports, with the main supplies coming from Qatar, Algeria, and Nigeria (see Table 1). LNG shipments arrive in Europe via Spain, UK, Belgium, France, Italy, Greece, Lithuania, Sweden, and in 2016 also via Poland, whereby Spain and the UK have the largest regasification capacities.

In light of increasingly difficult relations with Russia and the conflicts that emerged on the EU's northern and southern supply routes, natural gas supply diversification becomes ever more important (see for example Bilgin, 2009, 2011). One of the EU's strategies to improve supply security is to further develop the Southern Gas Corridor and a new gas hub in Southern Europe with additional quantities of natural gas coming from the Caspian, Central Asia, the Middle East as well as the Eastern Mediterranean (EC, 2016b).

The development of the offshore oil and gas discoveries in the Eastern Mediterranean countries of Egypt, Israel, Cyprus and Lebanon

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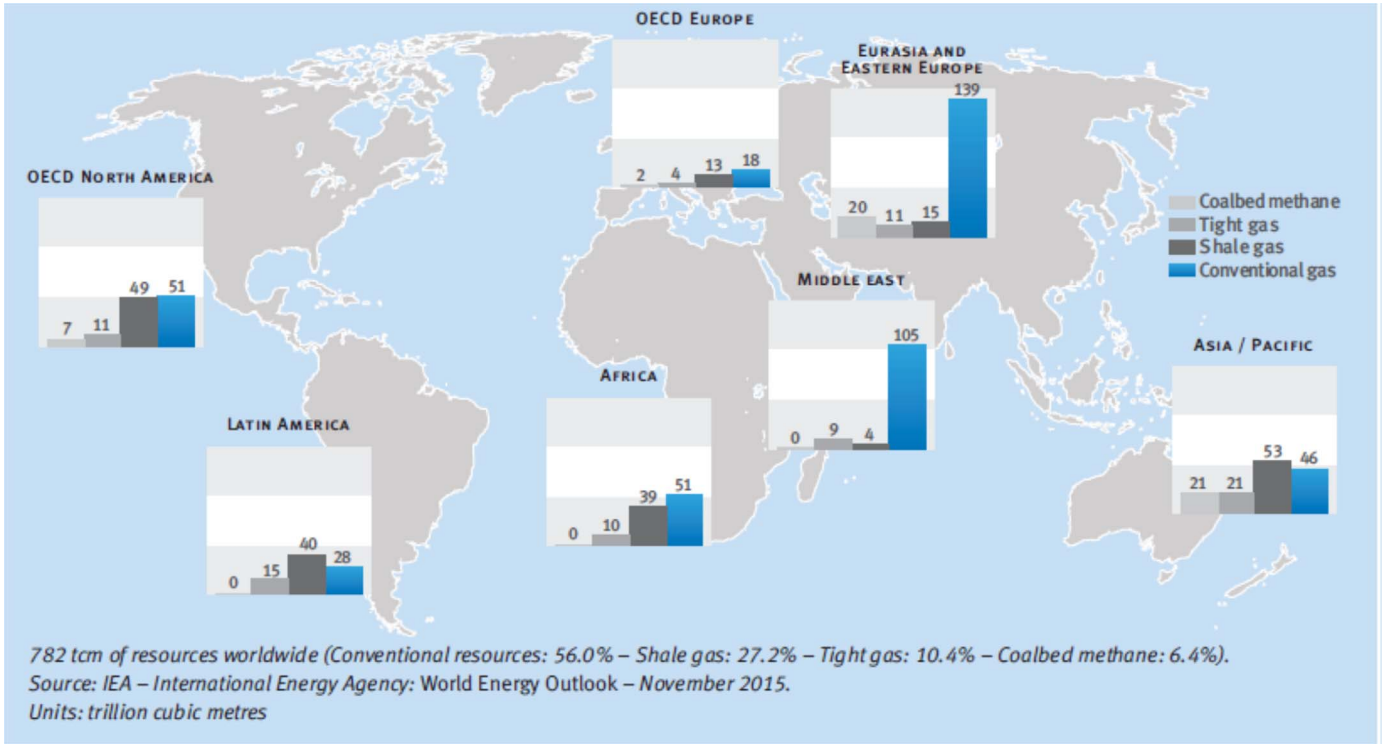

Fig. 1. Worldwide recoverable resources, end 2014.
(Source: Eurogas, 2015)

Table 1
EU LNG and pipeline imports in 2015.
Source: Adapted from Wood (2016).

Trade partner	**Import volume** (Bcm)	**Percentage share** (%)
Natural gas (pipeline) suppliers		
Russia	133.25	42
Norway	109.55	35
Algeria	20.67	7
Libya	6.5	2
LNG suppliers		
Qatar	26.10	8
Algeria	9.39	3
Nigeria	6.09	2
Norway	2.95	1
Trinidad	1.61	0.5
Peru	1.23	0.4
Oman	0.08	0.03
Total	317.42	100

(thereafter EICL) that has encountered various institutional, technical, and economic challenges, is witnessing a new momentum. The renewed dynamism in upstream explorations and field developments has been marked by the discovery of Egypt's Zohr field in 2015, which contains an estimated 30 Tcf of natural gas. Additionally, increased investments in other fields, such as for example BP's announced 12 billion USD investment in Egypt's Shorouk concession heightens the importance of the Eastern Mediterranean as a potential exporter. Furthermore, the so-called East Med pipeline has been classified as a Project of Common Interest (PCI) by the European Commission. PCIs are infrastructure projects that are considered essential to European energy policy and hence benefit from the possibility to receive financial support through the Connecting Europe Facility (EC, 2016c).

The increased interest in Eastern Mediterranean offshore oil and gas reserves has led to a growing literature on the topic. A full literature review is beyond the scope of this article, but some recent examples include Siddig and Grethe (2014), Ruble (2016), Ellinas et al. (2016) and Ratner (2016). This paper adds to the existing body of literature by analyzing the potential benefits that natural gas exports from the Eastern Mediterranean could have for the EU in its aim to increase natural gas supply security. It also provides some additional insights by forecasting domestic natural gas consumption needs in EICL for the years 2012 through 2042.

The paper is structured as follows. Section 2 presents an overview of the status quo of the EU-28's natural gas import dependency and its relationship to Russia. Section 3 analyzes the energy sectors of Egypt, Israel, Cyprus and Lebanon (thereafter EICL) including recent developments in the offshore oil and gas sector in these countries. Section 4 provides forecasts of potential domestic natural gas consumption needs in EICL for the period 2012–2042, and shows that substantial quantities of natural gas will be available for exports. Section 5 uses an empirical model to analyze the capital and transmission costs for exporting gas to Europe via the East Med pipeline. Section 6 presents a discussion of the results while Section 7 concludes the paper and provides policy recommendations.

2. The EU-28's natural gas import dependency and its relationship to Russia

2.1. The development of Europe's existing infrastructure

Europe's existing natural gas infrastructure stems from its long-standing relationship with Russia that developed in the middle of last century when Europe reduced its heavy reliance on coal and oil and introduced natural gas (Boussena and Locatelli, 2013). Natural gas from Russia was provided via pipelines, and the supplier-buyer relationship was based on long term contracts with 'Take Or Pay' (TOP) clauses and gas prices linked to oil. The transmission network

originated in central Russia, or countries of the former Soviet Union, and connected to big demand centers in Europe with little consideration for transit country needs (Özdemir et al., 2015). In Russia, and countries of the former Soviet Union, the existing pipeline network is controlled by Gazprom and therefore potential access for other suppliers is still limited (Özdemir et al., 2015).

Russia had been a reliable energy partner until the early 2000s when the first conflicts with transit countries arose. In 2006 and 2009 disputes over unpaid gas bills and price adjustments between Russia and two major transit countries, the Ukraine and Belarus, led to supply interruptions for several EU member countries. Furthermore, with roughly 15% (or 85 Bcm) of EU total gas demand transiting through the Ukraine (Gazprom, 2014), the conflict that emerged between Russia and the Ukraine in 2013, and the subsequent annexation of the Crimea by Russia, led to a further deterioration of relations between the Kremlin and the West.

2.2. The EU and Russia's divergent energy sector developments

Over the past two decades the EU has implemented major institutional reforms in its gas and electricity market aimed at increasing energy security by fostering competitive markets and sustainability. The Third Energy Package entered into force in September 2009 and aims at increasing efficiency in the natural gas and electricity markets by focusing on unbundling, the creation of independent national regulators, as well as the creation of the Agency for the Cooperation of Energy Regulators (ACER), an independent EU level body tasked with market oversight (EC, 2015). Cross-border trade and regional coordination is fostered through the European Network for Transmission System Operators in gas and electricity. The EU's natural gas strategy emphasizes supply diversification and the development of infrastructure interconnectivity (EC, 2015). Furthermore, the security of gas supply regulation (EU 994/2010) and the new regulation proposal of February 2016 have provided a regulatory environment that better prepares member states for potential gas supply interruptions by proposing a solidarity principle, a more regional approach, and numerous preventative measures (EC, 2016d).

2.3. Import dependencies and market power

Liberalizing markets and fostering cooperation certainly increases resilience and makes the internal energy market more competitive. However, it does not automatically foster import supply diversification. While import dependency across the EU-28 varies greatly, the existence of a well-developed pipeline network allows Russian gas to remain the most competitive option for EU member states (Boersma, 2015). Countries such as Bulgaria, Finland, Hungary, Slovakia, and Poland rely almost exclusively on Russian gas, making them particularly vulnerable to supply interruptions. Fig. 2 shows total natural gas supplies and the share of imports from Russia for EU member states. Note however that countries such as the Czech Republic or Poland did turn this situation around by investing in natural gas and electricity interconnections, in these cases, with Germany (Boersma, 2015). Furthermore, the examples of Poland and Lithuania show that the construction of LNG terminals can provide some protection against potential abuses of market power. In Lithuania, the new terminal led to renegotiated lower import prices on long-term contracts with Russia, whereas in Poland, which received its first LNG shipments in 2016, increased diversification implies increased energy security. Such investments would not be possible without subsidies from either the EU or national governments, hence there exists a premium for increased energy security (Boersma, 2015).

3. The offshore natural gas discoveries in the Eastern Mediterranean

3.1. Overview of key economic data of Egypt, Israel, Cyprus and Lebanon

The Eastern Mediterranean nations of Egypt, Israel, Cyprus and Lebanon (EICL) show large differences in terms of economic development, Gross Domestic Product (GDP), population, territory, institutions and energy sector development. In terms of per capita GDP, Israel ranks first, followed by Cyprus, Lebanon, and Egypt (see Table 2). A decomposition of GDP by sector indicates that services play a major role in all four countries, while industry is relatively more important in Israel and Egypt as compared to Cyprus and Lebanon (see Table 2). Agriculture accounts for a very minor share of GDP in Cyprus, Israel and Lebanon, while it accounts for a larger share in Egypt. Further details on key economic indicators can be viewed in Table 2.

3.2. The energy sectors of EICL – a comparative analysis

Egypt's energy sector is well developed but Israel, Cyprus and Lebanon were, until recently, considered energy poor. The discoveries in the Eastern Mediterranean Levantine basin that are estimated to contain 122 Tcf of mean total undiscovered natural gas reserves, 18.2 Tcf of proved natural gas reserves, as well as an estimated 1.7 billion barrels (bb) of oil and proved oil reserves of 2.5bb (Schenk et al., 2010) are gradually transforming the region into an energy hub. Table 3 provides an overview of resources for EICL.

The next section provides an analysis of the energy sectors in EICL, which despite their wealth in resources, are still to varying degrees, characterized by energy poverty and import dependency. In the case of Lebanon and Egypt this weighs heavily on public finances and consumers. The sluggishness in the development of the resource sector in EICL is due to a variety of challenges. The latter range from the implementation of an appropriate institutional framework in Lebanon, over decisions on market structure and quantities designated to exports in the case of Israel, to insufficient investment incentives in Egypt, and insufficiently large discoveries to justify infrastructure expenditures in the case of Cyprus.

3.2.1. Egypt's energy sector – current state and recent developments

Egypt's Total Primary Energy Supply (TPES) amounts to 74826 ktoe and is almost exclusively composed of fossil fuels with natural gas and oil accounting for respectively 54% and 40% (see Fig. 3). Egypt's total final energy consumption is highest in the following four sectors: transport (25%), industry (26%), residential (23%) and non-energy sector use (13%), while energy consumption in agriculture and forestry (5%) and commercial and public services (6%) is relatively low (see Fig. 4).

The Egyptian Natural Gas Holding Company EGAS reports that in 2015, domestic natural gas consumption amounted to 1842 Bcf, with the electricity sector accounting for 57%, followed by industry (28%), the petroleum sector (11%), the residential sector (3%) and the CNG sector (1%) (Egas, 2016). Egypt's power sector, with an installed capacity of 32015 MW (MOEE, 2016) relies on natural gas for close to 80% of electricity production while the remainder is covered by oil (12%), hydro (8%), wind (1%) and solar (< 1%) (see Fig. 5). The Egyptian government plans a substantial increase in installed capacity in the power sector over the coming decade. The government's plan also aims at increasing the share of renewable energy to 20% (EIA, 2015). In recent years, the tumultuous situation in the country led to a shortage in installed capacity and frequent power cuts. The current government under President Sisi has made the electricity and resource sector a priority. In terms of final electricity consumption, the residential sector accounts for the lion share of electricity consumed (43%), followed by industry (28%) and commercial and public services

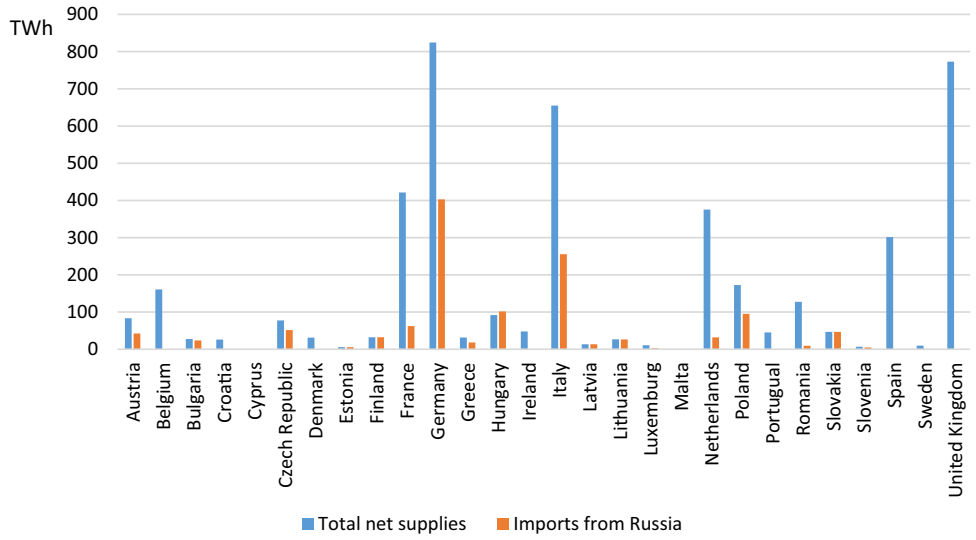

Fig. 2. EU-28 natural gas supplies and imports from Russia, 2014.
(Source: Eurogas, 2015)

Table 2
Key data for Cyprus, Egypt, Israel, Lebanon.
Source: data collected from CIA 2015a,b,c,d.

Country	Egypt	Israel	Cyprus	Lebanon
General				
Area km^2	1 million	20,770	9251[a]	10,400
Population in million	88.5	7.8	1.2	6
Economy				
GDP purchasing power parity (billion of USD; last year available)	946.6 (2014)	268.3 (2014)	21.62	64.31 (2013)
Per capita GDP PPP USD (2014 unless otherwise specified)	10,900[b]	33,400	24,500	15,800
Major sectors of the economy (in percentage share of GDP)				
Services	45.6	66.4	81.7	75.4
Industry	39.9	31.2	15.9	20
Agriculture	14.5	2.4	2.4	4.6
Economic growt% (estimates for 2014)	2.2	3.3	−2.8	1.5
Taxes as a share of GDP %	22.9	40.2	40.4	21.8
Public Debt % of GDP	93.7	67.1	113.1	120
Inflation %	10.1	1.7	0.2	5

[a] Of this surface 3355 km^2 are in Northern Cyprus.
[b] Estimate.

Table 3
Natural gas and oil reserves in Egypt, Israel, Cyprus and Lebanon.
Source: adapted from EIA (2013).

Country	Natural gas reserves (trillion cubic feet)		Oil reserves (billion barrels)	
	Estimated	Proved	Estimated	Proved
Egypt	–	77	–	4.4
Israel	33.42	6.7	0.61	0.012
Cyprus	7	–	3	–
Lebanon	25 – 96	–	0.87	–

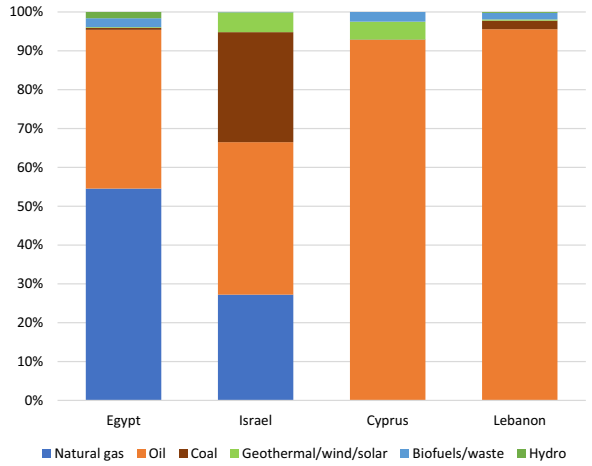

Fig. 3. Total primary energy supply for Egypt, Israel, Cyprus and Lebanon, 2014.
(Source: author's calculations based on data retrieved from IEA (2016a))

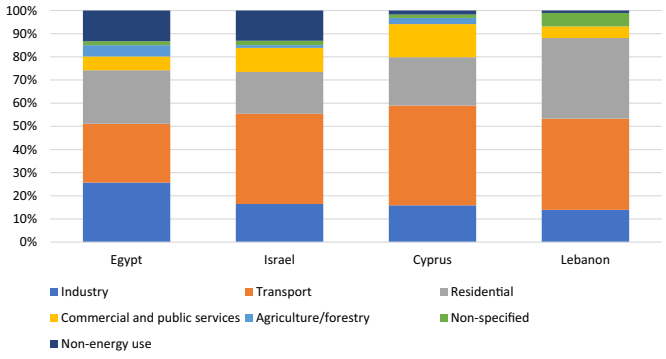

Fig. 4. Total final energy consumption for Egypt, Israel, Cyprus and Lebanon, 2014.
(Source: author's calculations based on data retrieved from IEA, 2016a)

(24%) (see Fig. 6).

3.2.1.1. Egypt's natural gas sector. Egypt is a resource rich country with a century of oil sector activity. Its resource sector is well developed, with foreign companies operating in the country since the early 1990s. Egypt possesses an extensive gas infrastructure with two LNG export terminals, Idku and Damietta, that have a daily capacity of

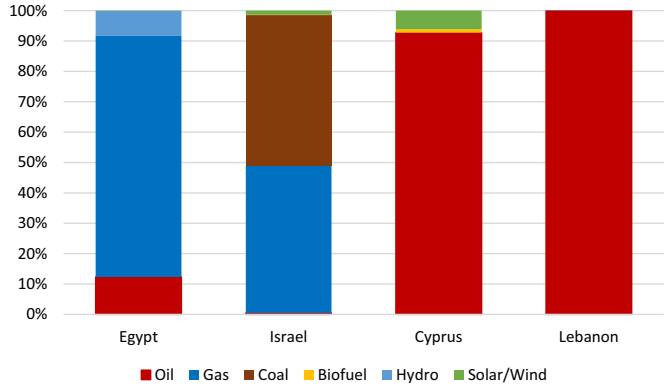

Fig. 5. Electricity production by fuel type for Egypt, Israel, Cyprus and Lebanon, 2014.
(Source: author's calculations based on data retrieved from IEA (2016a))

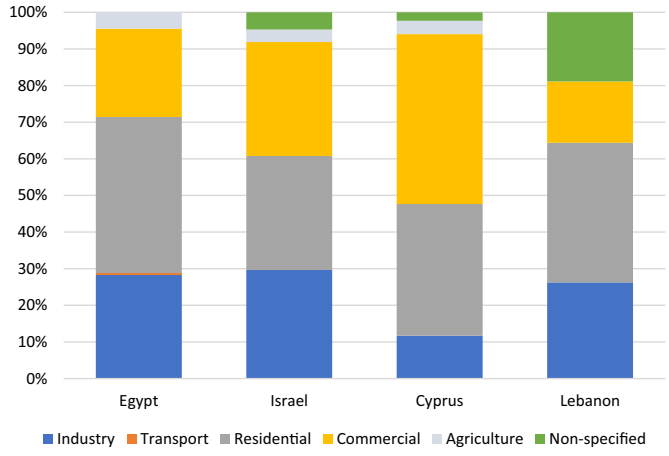

Fig. 6. Final electricity consumption shares by sector for Egypt, Israel, Cyprus and Lebanon, 2014.
(Source: author's calculations based on data retrieved from IEA (2016a))

Fig. 7. Arab Gas Pipeline.
(Source: By All the location_maps: NordNordWestderivative work: Amirki (talk) - Jordan_location_mapTurkey location mapHermon location mapIsrael location mapEgypt Sinai location map, CC BY-SA 3.0 de, https://commons.wikimedia.org/w/index.php?curid=17024429)

1.6 Bcf and a pipeline system that is connected to the Arab gas pipeline and thereby to Israel, Jordan, Syria and Lebanon (see Fig. 7).

Egypt is the largest non-OPEC oil producer and the second largest natural gas producer in Africa (EIA, 2015). Egypt's natural gas production increased substantially over the past decade, making it one of the world's 15 biggest gas exporters (Siddig et al., 2016). The gas sector also contributed an average of 8.3% to GDP from 2007 to 2012 (Siddig et al., 2016). However, during the past decade the poor management of its resource sector triggered by political turmoil, heavy subsidies to domestic natural gas consumers that burden public finances, and low prices offered to upstream foreign operators, slowed down investment and sector development. Gas production and exports declined over the period 2010–2015 while growth in domestic gas demand averaging 7% over the last decade led to the country becoming a net importer in 2011 with its two LNG export terminals being idle since then (Suding, 2011; EIA, 2015). In April 2015 Egypt started importing LNG and currently operates two leased floating regasification and storage units (EIA, 2015).

The year 2015 marked a positive turnaround in Egypt's resource sector, with significant new finds offshore its Mediterranean coast. The discovery of the Zohr field (30 Tcf) by the Italian firm ENI and the commitment of British Petroleum (BP) to a USD 12 billion offshore investment are expected to boost domestic gas production and transform Egypt into a net exporter starting in 2020 (Ellinas et al., 2016). The overall increased investment activity leads one to expect further discoveries. In the past few years the Egyptian government took several measures enhancing the attractiveness of its resource sector to investors, such as for example increasing prices paid to operators. The latter varied but would typically not exceed USD 2.65 per MMBTU. Prices paid for new concessions and renegotiated prices now vary between USD 3 and 5.9 per MMBTU (IEA, 2016b). In addition, the government initiated a fiscal reform package in 2014 reducing energy subsidies, and in August 2016 the parliament approved the introduction of a value-added tax to curb the budget deficit that had reached 11.5% of GDP in the fiscal year 2015–2016 (MEES, 2016). With natural gas production from the Zohr field expected to start in 2017–2018 and reaching about 972 Bcf a year in 2019, Egypt aims to return to self-sufficiency by 2020 and to resume its LNG exports in 2022 (Ellinas et al., 2016).

3.2.2. Israel's energy sector: current state and recent developments

For Israel TPES reached 22696 ktoe in 2014 and consists mainly of oil, natural gas, coal, and a small percentage of renewables (see Fig. 3). Imported oil comes from Russia and the Caspian, while coal mainly comes from South Africa and Venezuela (IEA, 2016a; Fischhendler and Nathan, 2014). In 2014 transport, residential energy consumption and industry account for respectively 39%, 18% and 17% of total final energy consumption (see Fig. 4).

The Israel Electric Corporation (IEC) is a public utility with an installed capacity of 13,617 MW. In 2014, IEC produced a total of 60813 GWh of electricity generated from coal 50%, natural gas 48% and for a very minor share from oil, solar PV, biofuel, hydro and wind (see Fig. 5).

Final electricity consumption amounted to 51318 GWh[1] in 2014 with the highest consumption shares in the residential and commercial, and public services sector, followed by industry (see Fig. 6).

3.2.2.1. Offshore oil and gas sector development. Israel's petroleum law was created in 1952 and drilling started in 1953, but it was only in 1999 that the first commercially viable offshore discoveries were made (MNIEWR, 2015). In 2004 the offshore Mari-B field (1.5 Tcf) started to

[1] The difference between electricity production and consumption is due to exports, the energy sector's own use and losses.

supply the domestic market, gradually satisfying up to 40% of Israel's natural gas consumption. In 2008, with the field's depletion, Israel started to gradually replace the latter 40% by imports from Egypt via an offshore connection of the Arab Gas Pipeline (Fischhendler and Nathan, 2014). However, import supplies came to a sudden halt in 2012, due to terrorist attacks and public criticism, and the Egyptian government cancelled the agreement (Siddig and Grethe, 2014). The sudden halt of natural gas deliveries from Egypt forced the Israel Electric Corporation to switch to oil and coal, which led to a substantial increase in electricity production costs (Siddig and Grethe, 2014). Current natural gas supplies come from the Dalit field (0.5 Tcf) and since March 2013 also from the Tamar field (10 Tcf) (EIA, 2013).

The discoveries of the Tamar (10 Tcf) and Leviathan (19 Tcf) fields in 2009 and 2010 have changed Israel's energy outlook as these fields would eventually allow for self-sufficiency and gas exports. Two major challenges had however slowed down the development of the Leviathan field in the past few years.

Firstly, determining the share of reserves dedicated to exports versus those for current and future domestic consumption led to debates at the national level. The so-called Zemach report, issued by an inter-ministerial committee considered 950 Bcm of natural gas as basis for setting policies and recommended allocating 53% of Israeli natural gas reserves to exports (State of Israel, 2012). Political debates however forced Prime Minister Netanyahu to reduce the latter share to 40% leaving 540 Bcm instead of 450 Bcm for domestic consumption for the next 25 years.

Proponents of this report argue that export restrictions would lead to inefficient field exploration and insufficient sector investment. Opponents on the other hand, claim that the Zemach report underestimates Israel's projected domestic consumption of natural gas by ignoring the energy industry's own use[2] and the losses in LNG processes.[3] They further claim that the report underestimates demand from the transport sector, and argue that the time horizon should be increased from 25 to 35 years (Berger, 2013).

The second hurdle to speedy sector development was the repeated intervention of Israel's Antitrust Commission in its attempt to prevent further concentration in a sector dominated by two firms, Noble Energy (US) and Delek (Israel) and their subsidiaries. The move was aimed at providing domestic customers such as the Israel Electric Corporation with more competitive prices (Jerusalem Post, 2014). In November 2016 however, the Petroleum Council of the Ministry of National Infrastructures, Energy and Water Resources announced its first competitive bidding-round for oil and gas exploration licenses for 24 offshore blocks and the closing date for bid submissions was recently extended from April to July 2017 (MNIEWR, 2017).

3.2.3. The energy sectors of Cyprus and Lebanon – some similarities

Cyprus and Lebanon lack any substantial infrastructure connections to the outside world. TPES in Cyprus and Lebanon accounts for 1973 and 7494 ktoe respectively (IEA, 2016a). In both Cyprus and Lebanon, the transport and residential sector combined account for the lion's share of total final energy consumption while industry accounts only for 16% and 14% respectively (see Fig. 4)). The reliance on oil in TPES in Cyprus and Lebanon is respectively 93% and 96% (see Fig. 3). With no domestic oil (or gas) production as of January 2017 these countries' import dependencies are extremely high, making them vulnerable to price fluctuations and sudden changes in their national energy bills. The latter accounted for 8.2% of GDP in Cyprus in 2012 where average electricity prices to households and industry have been consistently above EU-28 averages until 2015. In 2015 as consequence of the lower oil price, households paid slightly less than the EU-28 average while prices for industry remained above it (Eurostat, 2016). Cyprus' electricity sector has an installed capacity of 1477.5 MW (Cyprus Energy Regulatory Authority, 2015).

The extremely high reliance on oil in electricity production, reaching 93% in Cyprus and a staggering 99% in Lebanon highlights the urgent need for diversification (see Fig. 5). Note that both countries have witnessed a substantial increase in the deployment of renewables in recent years.

In Lebanon electricity prices to the household sector are highly subsidized, and government support to the public utility, Eléctricité du Liban (EDL), for fuel purchases reached an amount equivalent to 4% of GDP in 2012 (Ruble, 2016). EDL's installed capacity amounts to 2258.6 MW (EDL, 2016). Despite the existence of a backup generating sector that operates in a legal gray zone and provides roughly 50% of electricity consumed, as well as imports of electricity from Turkish power barges that are stationed off the coast of Lebanon, there is still a lack in installed capacity and the supply of electricity is characterized by lengthy daily power cuts.

3.2.3.1. Cyprus' emerging oil & gas sector. Cyprus has completed a first licensing round in 2007 and a second one in 2012 for a territory divided into 13 blocks located inside its EEZ[4] (Gürel et al., 2013). Following these licensing rounds, Total has received the exploration rights to block 11, on which it is planning further explorations in 2016 (Natural Gas Europe, 2015) and the US based Noble Energy International received the exploration rights for block 12 followed by a production sharing agreement. The most important discovery so far is the Aphrodite field, containing an estimated 4.1–6 Tcf, of which British Gas acquired 35% in 2015. The 2015 discovery of Egypt's Zohr field has motivated Cyprus' third licensing-round for blocks 6, 8 and 10 in 2016. In December 2016 Cyprus announced that the winners of the third licensing round with whom exploration and production sharing agreement contracts will be signed are ENI Cyprus and Total Exploration and Production Cyprus for block 6, ENI Cyprus for block 8, and Exxon Mobil Exploration and Production Cyprus and Qatar Petroleum International for Block 10 (Ministry of Energy, Commerce, Industry and Tourism, 2016).

3.2.3.2. Lebanon's successful development of an institutional framework for its nascent oil and gas sector. Lebanon started to drill its first onshore wells in the Bekaa valley from 1947 to 1967. A long civil war, lasting from 1975 to 1991, as well as conflicts with neighboring countries, have diverted attention away from the resource sector. In 1993 a first offshore 2D seismic survey was conducted for a small area in northern Lebanon by Geo-Prakla. Later, Spectrum and PGS carried out 2D, and in the case of PGS also 3D surveys in the periods 2000–2002, and 2006–2012 respectively. Additionally, further 3D offshore and 2D onshore surveys were conducted in 2013, and in 2015 Neos Airborne conducted a Geophysical survey (LPA, 2016). Estimates of Lebanon's estimated offshore natural gas resources range from 25 to 96 Tcf. The high uncertainty is due to diverging survey results and because no drilling in any of the 10 offshore blocks took place to date.

Over the past decade great progress in the establishment of the institutional structure of Lebanon's emerging oil and gas sector was made. The country followed the successful Norwegian example and

[2] On average, around the world, the energy industry's own use typically varies from 3.5% to 9.5% of reserves.

[3] Losses in LNG processing typically amount to 15%.

[4] "An Exclusive Economic Zone (EEZ) is a concept adopted at the Third United Nations Conference on the Law of the Sea (1982), whereby a coastal State assumes jurisdiction over the exploration and exploitation of marine resources in its adjacent section of the continental shelf, taken to be a band extending 200 miles from the shore." (OECD, 2017)

benefitted from support through the Norwegian Development Aid Agency to establish a legal framework, transparent management rules as well as adequate licensing procedures. The Offshore Petroleum Resource Law that governs the oil and gas sector was adopted in 2012 and the Lebanese Petroleum Authority (LPA) that counts six members, each representing one of Lebanon's major religious sects, was established in the same year. The first licensing-round for offshore exploration and production was launched in May 2013. However, due to the dire internal political situation, with a caretaker government ruling from March 2013 until February 2014 and the inability to agree on a new President for over two years the decision-making process in the country was nearly paralyzed. Despite the unstable regional situation and the ongoing domestic political disputes the election of a new president in October 2016 gives new hope for speeding up the development of Lebanon's offshore resources. In January 2016 the government approved two decrees that will allow to finalize the areal determination of offshore resource blocks as well as the rules and regulations pertaining to exploration and production agreements (Ruble, 2016). Consequently, the bidding rounds that were launched in 2013 and extended several times can now be concluded. This will allow Lebanon to speed up the development of its offshore resources.

3.3. Exclusive Economic Zones (EEZ)

To develop their exports, countries need to determine their destination markets. Consideration is given to prices, that vary between possible export markets, as well as transport cost and geopolitical factors. Furthermore, EICL have on the one hand an interest in cooperation to achieve efficient exploitation of their resources but on the other hand they are also competing for regional markets, at least in the case of Israel, Cyprus and Lebanon. In either case, fighting over Eastern Mediterranean resources would be counterproductive.

For successful exploitation, several EEZ agreements have been signed. Cyprus has signed an EEZ agreement with Egypt in 2003, Lebanon in 2007, and Israel in 2011. Israel and Egypt have ratified the agreements, whereas Lebanon has not yet done so because of disagreements on its maritime border with Israel. The Lebanese government has brought the issue to the UN in 2010 (Ruble, 2016). Note however that a conflict between Israel and Lebanon because of this disagreement is highly unlikely. Both countries have an interest in appearing as reliable suppliers and have therefore avoided to issue exploration licenses for the blocks that overlap with the disputed area in licensing rounds so far. Further note, that there are no EEZ agreements between Turkey and Cyprus, or between Cyprus and Greece or Syria.

In the case of Cyprus, the current size of its discoveries requires the cooperation with either Israel and/or Egypt to find a commercially viable way to bring its gas to market, as potential domestic consumption is too low to justify necessary infrastructure investments. Furthermore, Turkey did not sign the UN Convention on the Law of the Sea and is the only UN member that does not recognize Cyprus (Republic of Cyprus, 2011). The Republic of Northern Turkey, established by Turkey in 1974 claims some of the blocks within the Cypriot EEZ. Over the past few years, Turkey's violations of Cyprus' EEZ while carrying out seismic surveys has led to the repeated breakdown of peace talks aimed at reuniting the Island. A detailed discussion of Cyprus' relation with Turkey concerning the resource sector can be found in Giamouridis (2012).

3.4. Increased regional cooperation and infrastructure interconnectivity

Regional cooperation, that is driven by economic and political consideration is evolving slowly. For example, Israel and Cyprus have signed several cooperation agreements in recent years. However, progress was slow as commercial viability and therefore interest by investors was relatively low until the discovery of the Zohr field in 2015. In August 2016, Cyprus signed the first of three agreements for the export of its natural gas via pipeline to Egypt (NGWM, 2016). Cypriot gas will then either be used to satisfy domestic demand in Egypt or transported to the Idku or Damietta plants for further export in the form of LNG (NGWM, 2016). The three trading agreements are intended to provide a framework that would increase the attractiveness of investment (NGWM, 2016).

Furthermore, in September 2016, the operators of the Leviathan basin agreed with Jordan's National Electric Power Company (NEPCO) to deliver 0.11 Tcf of natural gas yearly for fifteen years. The gas will be delivered via a new pipeline connected to Israel's existing network and extending into Jordan (Jerusalem Post, 2016). The new pipeline extension will increase regional interconnectivity and deliveries will start in 2019. Prices are linked to oil and the contract includes a TOP clause with the option to increase deliveries by 15% (Jerusalem Post, 2016).

4. Forecasting domestic natural gas consumption for EICL

4.1. Methodology

To determine the volume of gas potentially available for exports, projected natural gas consumption in EICL over the period 2017–2042 has been calculated. The base year for calculations is 2012 as comprehensive data for the four countries were only available up to the end of 2012. Where available more recent data have been incorporated. Population projection data has been retrieved from The World Bank (2016a), while GDP and energy intensity data for the base year have been retrieved from The World Bank (2016b, c). Note that as highlighted in Section 3 the share of natural gas in TPES in the base year varies from 0% in Cyprus and Lebanon, to 24% in Israel and 52% in Egypt.

To calculate projected natural gas demand for the two developing countries in our group, Egypt and Lebanon, we follow the methodology of Demierre et al. (2015) in which GDP per capita and population growth are the main drivers of primary energy demand. Poorer countries are assumed to grow faster than their richer trading partners allowing for convergence in per capita GDP (Hsiao and Hsiao, 2004; Demierre et al., 2015). Following Demierre et al. (2015) the growth rate of GDP per capita in developing country i is determined by:

$$\frac{d(\ln GDPi)}{dt} = r(lnGDP_R - lnGDP_i) + GDPG_R \quad (1)$$

where GDP_i and GDP_R are respectively the developing and the developed country's per capita GDP. $GDPG_R$ is the EU's average per capita GDP growth rate, which was set at 1.5%. $GDPG_R$ has been chosen because of the geographical proximity of the Eastern Mediterranean to Europe and because the EU is both Egypt's and Lebanon's most important trading partner. The constant r captures the speed at which countries are catching-up to reach the EU's per capita GDP.

Similarly, per capita GDP for both Lebanon and Egypt in year t has been calculated from:

$$GDP_{i,t} = GDP_{i,t-1} e^{[GDPG_R + r(lnGDP_{R,t-1} - lnGDP_{i,t-1})]} \quad (2)$$

Cyprus, an EU member state, and Israel an OECD member country, are both developed countries. We have therefore assumed their per capita GDP to simply grow at the EU's average rate of 1.5%.

For each of the four countries under consideration, energy needs per capita (EPC) were calculated by:

$$EPC_{i,t} = GDP_{i,t} I_t \quad (3)$$

where I_t is energy intensity of GDP (kgoe/$) at year t, computed from:

$$I_t = (1 - \varepsilon) I_{t-1} \quad (4)$$

where ε is the annual change in energy intensity, set at 1.14%.

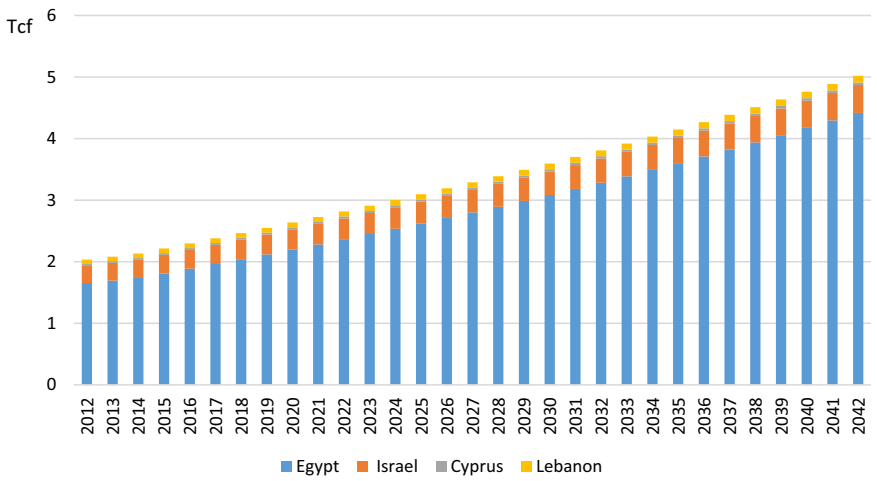

Fig. 8. EICL, projected domestic natural gas consumption for the period 2012–2042.

This methodology has allowed to calculate the potential natural gas demand for country i in year t, NGD_{it} as follows:

$$NGD_{it} = X_{NG} \times EPC_{it} \times POP_{it} \quad (5)$$

In Eq. (5) X_{NG} is the country specific share of primary energy use that is satisfied with natural gas, and $POP_{i,t}$ is the projected size of the population in country i in year t.

4.2. Projected domestic natural gas consumption in EICL

Total cumulative natural gas consumption for the four countries for the years 2017–2037 and 2017–2042 is projected to reach 70 and 94 Tcf respectively. Thus, there will potentially be large quantities of gas available for exports.

Fig. 8 presents the forecasted domestic consumption needs for EICL. Considering a twenty-five-year horizon from 2017 to 2042, the forecasts for Egypt, which is by far the largest consumer of natural gas within this group show that yearly domestic consumption needs will reach 4.4 Tcf (see Fig. 8) by 2042 while projected cumulative consumption amounts to 80.4 Tcf in the same year. Israel's domestic consumption will require 0.45 Tcf in 2042 while its projected cumulative consumption needs reach 9.9 Tcf by 2042 (see Fig. 8). Note that the results for the projected natural gas consumption in Israel are lower than those provided by the Israeli government. The latter are based on several strong assumptions, with the most important being a natural gas penetration rate in the electric power production that will reach 60% and 68% in 2027 and 2040 respectively, and the use of natural gas in transport reaching 0.14 Tcf in 2040 (MNIEWR, 2017).

Although Lebanon and Cyprus are at an earlier stage in sector development it is important to note that these countries' domestic consumption needs are rather minor in relation to estimated discoveries and hence the export potential is significant. This is particularly true in the case of Lebanon where yearly natural gas consumption is forecasted at 0.11 Tcf in 2037 while cumulative consumption needs for the period 2017–2042 amount to 2.4 Tcf (see Fig. 8). Cyprus is the smallest consumer, with yearly domestic natural gas consumption projected at 0.04 Tcf in 2042 while cumulative consumption amounts to 0.93 Tcf for the years 2017–2042 (see Fig. 8). The share of natural gas in primary energy use in Cyprus and Lebanon has been assumed to correspond to the forecasted share of this variable for the EU by 2050, which is 25% (EC, 2016a).

5. Estimating capital and transmission costs for the East-Med pipeline

The above calculations show that potentially large quantities of Eastern Mediterranean gas could become available for exports, hence a natural gas pipeline connecting Cypriot, Israeli, Egyptian and possibly Lebanese gas fields to the European pipeline system could be very beneficial to both suppliers and buyers. The East Med pipeline presents an opportunity for the EU to both develop its Southern Gas Corridor further and diversify away from its heavy reliance on Russian gas.

This section thus analyzes pipeline capital and transmission costs for the so called East Med pipeline that spans from the offshore Levantine Basin to Cyprus, Crete and the Greek mainland where it joins the Poseidon pipeline. We ignore upstream field development costs and assume a wellhead price of USD 3 per MMBtu of natural gas. With this routing option the pipeline will have a length of 1700 km of which only 500 km will be onshore while the remaining 1200 km will be offshore.

Following Demierre et al. (2015) Eq. (6) through 9 present a simple empirical model, used to estimate capital and transmission costs.

Transmission costs C_T presented in USD per MMBtu are calculated based on the following model:

$$C_T = \left\{\left(\frac{(CRF + MC)C_l}{Q} + FC\right)L\right\}/1.027\times10^6 \quad (6)$$

where *CRF* is the capital recovery factor detailed in Eq. (7), *MC* is the ratio of annual maintenance costs to initial investment and is assumed to be 5%, while C_l is the pipeline unit capital cost in USD per kilometer (Eq. (8)). Q is the average gas volume flow in billion cubic feet (Bcf) per year, FC is the fuel cost for compression assumed to be 150 USD per Bcf and kilometer, and L is the pipeline length equal to 1700 km.

The capital recovery factor, *CRF* amounting to 0.089 is based on an interest rate i of 8% and a pipeline lifetime, n of 30 years:

$$CRF = \frac{i(1+i)^n}{(1+i)^n-1} \quad (7)$$

Following Demierre et al. (2015) we used a simple econometric model to estimate the unit cost of capital C_l in million USD per kilometer:

$$C_l = a_0 + a_1 Q_0^{0.5} + a_2 Q_0 + u \quad (8)$$

where $Q_0 = (1 + m)Q$ in which Q is the average capacity volume and m is the capacity margin, assumed to be of 30%, a standard figure used in the literature.

The parameters a_0, a_1, a_2 represent different aspects of pipeline costs, while u is the error term that is assumed to follow a normal distribution with mean 0. To minimize transportation cost a variety of factors such as the length of the pipeline, the diameter of the pipe as well as the number of compressor stations and other technical and logistical factors are typically considered (EIA, 2016). Typical cost factors in pipeline estimates include design engineering, right of way,

Table 4
Capital and Transmission Costs.

	Pipeline A (Q=15)	Pipeline B (Q=25)
Pipeline capacity Qo (Bcm)	19.5	32.5
Capital cost (million USD per km)	3.7	5.06
Transmission cost (USD/MMBtu/100 km)	0.248297647	0.248297326

legal, environmental and safety related costs, construction, materials, and overheads. The data set used covers 96 projects of different characteristics carried out in the U.S. during the period 1995–2016. The estimated unit capital cost forecasts, based on this simple model deliver realistic estimates for natural gas pipelines built in different parts of the world (for further details see Demierre et al., 2015).

The functional form in Eq. (8) is widely used in the literature and is motivated by technical background. Using an Ordinary Least Squares (OLS) regression to estimate the coefficients, the resulting values for a_0, a_1, a_2 are 0.4215, 0.096 and 0.011 respectively. These estimates are statistically significant at the 5% level. The coefficient of correlation, R^2 equals 0.31, which is acceptable in the case of cross-sectional data.

6. Results and discussion

6.1. Results in light of current and projected market prices

From the above presented Eq. (6) through 9 capital and transmission costs were calculated for two possible pipeline capacities (Q_0) of 19.5 Bcm and 32.5 Bcm, resulting in yearly average gas volume flows (Q) of 15 and 25 Bcm respectively.

Table 4 shows that total capital costs for pipeline A amount to 6.3 billion USD while for pipeline B these costs amount to 8.6 billion USD. Transmission costs on the other hand hover around USD 0.25 per MMBtu for 100 km. Assuming the cost of pipeline quality gas entering the system in the Eastern Mediterranean is USD 3 per MMBtu adding the cost of transportation, the gas can be offered USD 7.22 per MMBtu at destination. Prices in the day ahead market at European gas midpoints on February 7th, 2017 ranged from USD 6.814 per MMBtu at the German GASPOOL to USD 7.551 per MMBtu at the French Trading Region South (TRS) hub (Platts, 2017). Under these market conditions, East Med pipeline gas supplies would be marginally competitive in Southern Europe.

The 2016 World Energy Outlook's New Policies Scenario (its most plausible scenario) forecasts that by 2025 gas prices will increase to USD 4.7, 9.2 and 11.3 per MMBtu in the US, Europe and Japan respectively while by 2040 prices will reach USD 7, 11.5, and 12.4 per MMBtu in the three regions respectively (IEA, 2016c). Furthermore, the EU's net gas imports are projected to increase to 380 bcm by 2040 (see Fig. 9). In the process, the EU's natural gas supply security is expected to improve through more diversified pipeline gas sources and increased LNG imports from Qatar, the U.S. and possibly other suppliers. The share of LNG in overall EU gas imports is forecasted to increase from 10% in 2014 to over 30% in 2040 and Fig. 9 reflects the expectation of increased imports from North America (IEA, 2016c). EU natural gas import diversification would greatly improve with U.S. LNG imports. Hence, we are now turning to a brief analysis of the competitiveness of U.S. LNG shipments to Europe.

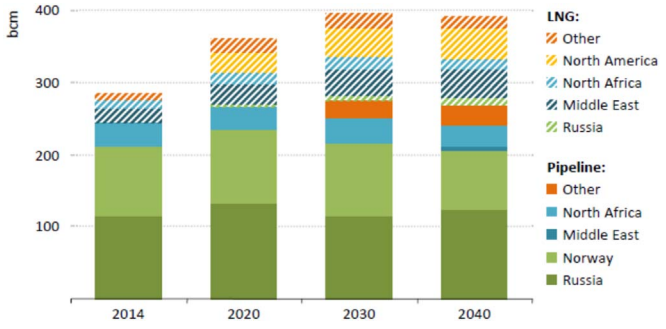

Fig. 9. Natural gas imports in the EU by exporter and transport mode in the World Energy Outlook's New Policies Scenario.
(Source: IEA, 2016c)

6.2. The potential role of U.S. LNG shipments to Europe

The emerging role of U.S. LNG exports as a game changer on world gas markets has received increased attention in recent years (see for example: Medlock et al. (2014), Ripple (2016), Salameh (2016), Tunstall (2016) and Foss and Gulen (2016), to name just a few major contributions). US natural gas production has increased by over one third from 2005 to 2014 (FERC, 2015). This extraordinary boom in the natural gas sector was made possible by favorable price developments and by technological advances that have allowed unconventional natural gas resources to become highly profitable. In 2016 the latter account for roughly 50% of U.S. natural gas production. Increased efficiency in production and subsequent abundant supplies led to prices ranging from 2 to 5 USD per MMBtu (Ripple, 2016). The rising spread between LNG landed prices in the U.S. and other major hubs worldwide started in the second half of 2010 and in 2011 led to a surge in permit and license applications for the development of LNG export terminals (Ripple, 2016).

In recent years, however, reduced gas demand growth, abundant LNG supplies, a sharp drop in the price for crude oil in 2014, and the subsequent drop in gas prices around the world led to a more challenging environment for LNG exporters. Squeezed profit margins slowed down upstream sector investment for two consecutive years in 2015 and 2016. LNG companies are staging large projects over time to reduce risks and some have developed a preference for smaller projects with shorter lead times allowing for more flexibility in the face of uncertainty. In the current low price environment, many LNG export companies are placing on hold export terminals that have been approved by the U.S. Department of Energy and the Federal Regulatory Commission. These projects can be viewed as options, that would allow companies to react swiftly should more favorable market conditions prevail in the future (Ripple, 2016). In fact, U.S. LNG exports are expected to further increase from an average of 0.5 Bfc per day in 2016 to 2.6 Bcf per day in 2018 (EIA, 2017).

Ripple (2016) estimates the cost for U.S. LNG delivered to Belgium's Zeebrugge terminal to range from USD 5.12 per MMBtu to USD 5.98 per MMBtu. His calculations are based on a Henry Hub price of USD 2.15 per MMBtu and shipping costs ranging from USD 0.4 per MMBtu to USD 1.26 per MMBtu. Late 2016 H Hub prices have slightly increased and fluctuated around USD 3 per MMBtu. Following Ripple's methodology of LNG export price calculations, and assuming a Henry Hub price of USD 3 per MMBtu, and taking transport costs into account, LNG could be delivered to Europe's Zeebrugge Terminal for USD 5.8 per MMBtu to USD 8.21 per MMBtu.

LNG landed prices in Zeebrugge in December 2016 however averaged USD 5.58 per MMBtu (FERC, 2017) making U.S. LNG exports to Belgium not yet commercially viable. As markets rebalance and prices rise U.S. LNG shipments could become an increasingly attractive option for EU gas supply diversification and represent a threat to incumbent market players. The anticipation of increased U.S. LNG shipments to Europe and the incumbents' aim to defend their market shares, has among other reasons led to natural gas exports from Norway and Russia to reach all-time highs in 2015 and 2016 respectively. To fully appreciate the potential benefits of the East Med pipeline several additional factors need to be considered.

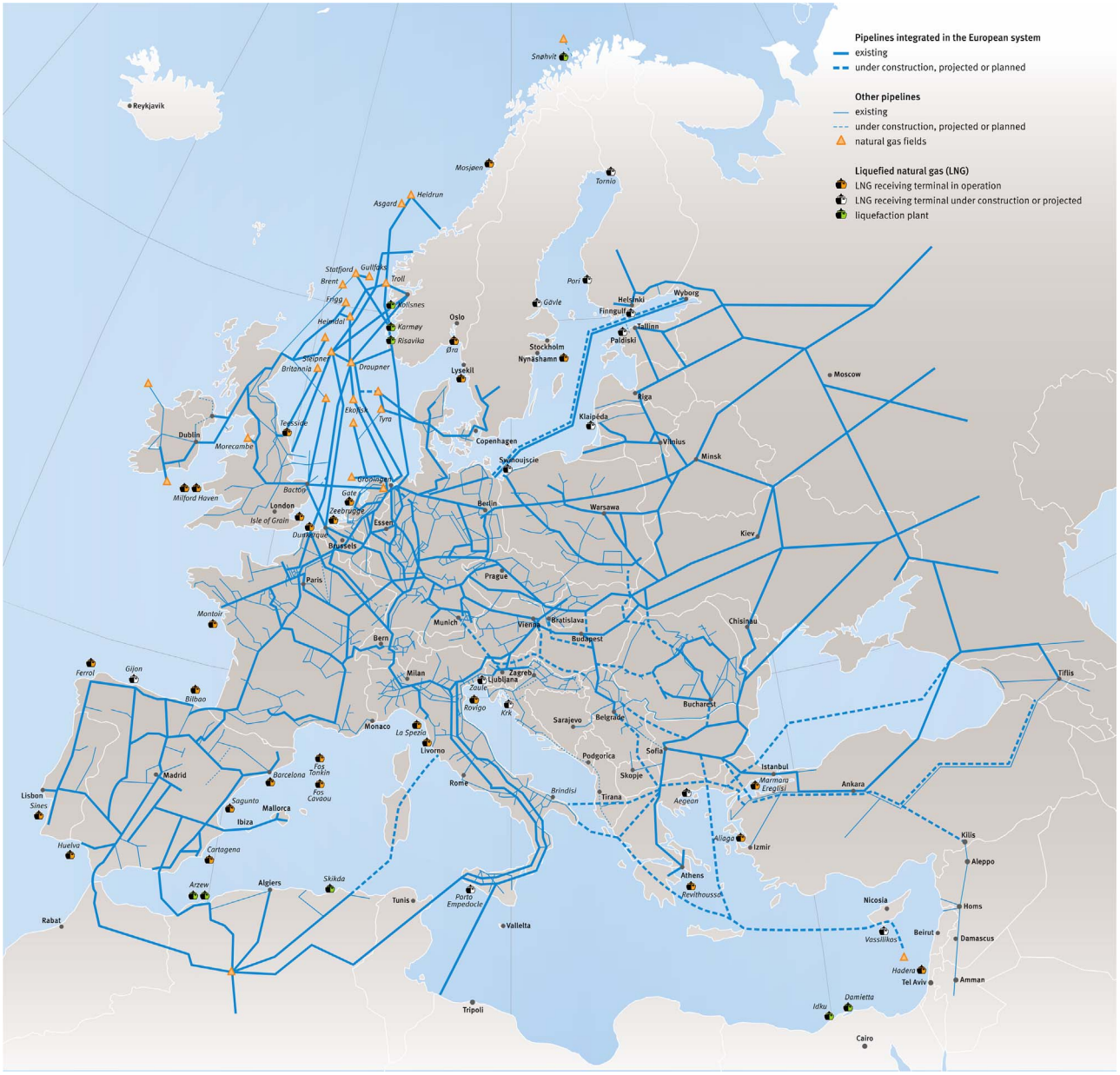

Fig. 10. Pipelines integrated in the European system (Eurogas, 2015).

6.3. Diverging developments in market structure between the EU and its neighbors

Europe has increasingly liberalized its natural gas and electricity market, the same is true for Turkey where the energy sector has undergone major changes since 2001, and where the Trans-Anatolian pipeline (TANAP) will bring further liquidity and competition in the natural gas market (see Fig. 10). The energy sectors of Russia and those of other former Soviet Union countries, on the other hand, have an oligopolistic market structure (Westphal, 2014) and this adds an additional layer to an already difficult political relationship with the West. Europe's energy market liberalization implies that it is composed mainly of private actors following market signals in a quest for profitability (Boersma, 2015). Under these circumstances the benefits provided by energy security might not enter companies' calculations when maximizing profitability (Boersma, 2015).

6.4. The controversy of new supply routes into Europe

Russia's ambition to hold on to its dominant role in Europe's energy imports, while coping with an increasingly competitive low price environment, where project profitability becomes more important is reflected by the frequent changes to pipeline projects. These changes reflect political disagreements between the EU and Russia, or, in some cases intra-EU disagreements. For example, the South Stream pipeline project was cancelled in 2014 due to EU sanctions against Russia. A year later the planned Nordstream 2 pipeline led to heated political debates as geopolitical considerations in the pursuit of supply security clashed with economic interests of various EU member states (Der Spiegel, 2015). Southstream would have mainly benefitted Hungary and Italy, while Nordstream 2 would make Germany the main natural gas distribution hub in Europe. Immediately after the cancellation of South Stream, Russia announced Turkish Stream, a pipeline that would

bring Russian natural gas through the Black Sea to Turkey. This project was subsequently cancelled by Russia in December 2015 following the downing of a Russian warplane by Turkey. However, in October 2016, presidents Putin and Erdogan signed an agreement reviving the Turkish Stream pipeline project that would allow Russia to deliver its gas directly into the heart of Europe (The New York Times, 2016). These are just a few example showing Russia's ambitions at maintaining and strengthening its market position in Europe, allowing it to wield political influence, while benefitting from a stable market that offers attractive prices.

6.5. The Southern Gas Corridor

Three new pipelines, TANAP, the Trans Adriatic Pipeline (TAP), and the South Caucasus Pipeline Expansion (SCPX) are under construction to develop Europe's Southern Gas Corridor that was proposed in 2008 to foster the role that Eurasian and Middle Eastern supplies could play in Europe's quest for increased natural gas supply security (Özdemir et al., 2015). TANAP crosses Turkey from its eastern to its western border with Greece and connects to the TAP. TANAP will carry an initial volume of 16 Bcm of Azeri natural gas reaching 31 Bcm by 2026. Of the initial annual amount 10 Bcm will be delivered to Europe (to Bulgaria, Greece and Italy) and 6 Bcm exiting in Turkey (Özdemir et al., 2015). Through an extension TANAP will also be connected to the South Caucasus pipeline (Özdemir et al., 2015). The revival of Turkish Stream that could be further connected with TANAP is met with criticism by several EU members and the US. While TANAP leads to diversification by bringing non-Russian supplies to the EU market, this is not the case with Turkish Stream. Furthermore, geopolitically it might not be wise for the EU to have increasing amounts of natural gas transiting through Turkey. Similarly, Israel's new rapprochement to Turkey and talks of a possible pipeline connecting Israel's offshore resources to Turkey are mainly driven by market considerations. Turkey is an attractive market for potential Eastern Mediterranean suppliers because of its geographic proximity, attractive domestic gas prices and sufficiently high demand. While economically attractive, this option is not optimal from the perspective of EU natural gas supply security.

6.6. Syria

Syria is rich in fossil fuel reserves and has a strategically important position however, due to the ongoing conflict that started in 2011 Syria has not been included in our calculations. Once the war ends, Syria has the potential to become an important regional player again. Syria's proved crude oil reserves amount to 2.5 billion barrels and that makes it the country with the largest oil reserves in the Eastern Mediterranean. In 2016 it's proved natural gas reserves on the other hand were estimated at 8.5 Tcf (CIA, 2017). Prior to 2011, natural gas was used domestically, primarily for electricity production and crude oil production averaged nearly 400,000 barrels per day in the period 2008–2010, with net exports slightly exceeding 100,000 bbl/d in 2010 (EIA, 2011). Over 90% of Syrian oil exports were delivered to EU countries, creating important foreign currency revenues for its government (EIA, 2011). After the onset of the Syrian war, US and EU sanctions prevented further sector development and International Oil Companies have stopped exploration activities. The ongoing conflict has severely damaged Syrian energy infrastructure, both oil and gas pipelines as well as the electric grid. An end to the conflict would allow Syria to resume its ambitions to expand its pipeline network beyond the existing Arab Gas Pipeline and connecting to countries like Iran, Iraq, Azerbaijan or Egypt via Jordan. Prior to 2011, Syria was also planning to expand its domestic gas pipeline network by building a pipeline from Homs to the Turkish border. Only an additional short pipeline inside Turkey would have to be built to connect to the Turkish network and this would ultimately allow for its resources to reach the European continent. In December 2013 Syria has granted the Russian company Soyuzneftegaz a 25 year concession to a 2190 km^2 area off its northern coast (Financial Times, 2013). Soyuzneftegaz has thereby acquired the rights for exploration, drilling, development and production and Russia can potentially expand its regional influence (Financial Times, 2013).

6.7. The East Med pipeline security benefits

Imports of natural gas via the East Med pipeline present an opportunity for the EU to truly diversify supply sources away from its heavy reliance on Russian gas in a time of conflict on or near several EU borders, such as in the Ukraine and Syria. Simultaneously, Turkey, whose relation with the EU has deteriorated in recent years, is increasingly suffering from instability and the potential for serious internal conflicts due to its intervention in foreign conflicts, the recent coup attempt and the erosion of rule of law. Conflict inside of Turkey could ultimately affect its reliability as a transit country.

In this context, a pipeline spanning from the Eastern Mediterranean to Europe presents a great number of advantages. Firstly, supply diversification away from Russia and towards countries such as Cyprus, an EU member state, Israel a strong ally, Egypt and Lebanon long-standing trade partners of the West can be considered beneficial. Secondly, the increased activity in exploration and development in offshore fields led Cyprus and Egypt to sign an agreement aimed at initiating the construction of a pipeline from Cyprus' Aphrodite field to Egypt. This provides increased regional pipeline interconnectivity, can facilitate exports through access to additional fields to feed into the East Med pipeline, while also allowing Cyprus to provide gas to the Egyptian market or make use of its LNG export terminals. Thirdly, and most importantly the East Med pipeline would allow Europe to develop its Southern Gas Corridor by fostering economic development within its borders. This could happen by supporting Greece to become a southern energy hub, developing inner-EU infrastructure capacity and interconnectivity where it is desperately needed, in South-Eastern Europe, and thereby fostering an increased penetration rate of natural gas and economic growth in a region that is in dire need of more economic development.

7. Conclusions and policy implications

This paper has shown that the Eastern Mediterranean offshore oil and gas resources of Egypt, Israel, Cyprus and Lebanon have the potential to transform the region into an energy hub that could contribute to EU natural gas supply diversification and thereby increase its energy security. The increased discoveries and investment activities in offshore oil and gas exploration and production will allow these countries to transition from importers to net exporters. Forecasts of domestic natural gas consumption for the years 2017–2042 show that potentially large quantities of natural gas could be available for exports. The EU could benefit from this regional transition through the construction of the East Med pipeline which would further develop its Southern Gas Corridor by truly diversifying its supplies away from Russia, while also avoiding increasingly unstable transit countries. Further EU funding to increase the attractiveness of this project that has already been classified as a Project of Common Interest by the European Commission might be a small premium to pay for the potential benefits that the East Med pipeline will provide.

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