Natural Gas in the Eastern Mediterranean

Economic Impacts and Strategic Implications

Editors:

Dr. Roby Nathanson

Hadar Weisman

Amit Loewenthal

Tel Aviv,

November 2013

©All copyrights belong to Friedrich-Ebert-Stiftung and the Institute for National Security Studies.

The commercial use of media published by FES without written permission by FES is strictly forbidden

Cover by Assaf Ben-Ari,
assaf-ba@bezeqint.net

ISBN 978-965-7523-25-4



Table of Contents

INTRODUCTION 6

RECENT DEVELOPMENTS OF EXPLORATIONS, FINDINGS AND PRODUCTION IN THE REGION 8

THE ECONOMIC LENS 16

TAXING AND EXTRACTING NATURAL RESOURCES 16

TZEMACH COMMITTEE - RECOMMENDED EXPORT QUANTITIES AND THE GOVERNMENT DECISION 18

ARGUMENTS FOR AND AGAINST LARGER EXPORT QUOTAS 19

INVESTORS - PRINCIPLE AND ECONOMIC ARGUMENTS 21

COMPARISONS TO OTHER COUNTRIES 22

THE PUBLIC DISCUSSION AND POLITICAL ASPECT OF THE EXPORT DECISION 23

DISCOUNT RATE AND HORIZON 24

NEEDS AND EXPECTED INCOME 24

RISKS, DIVERSIFICATION AND ISRAEL'S ENERGY SECURITY 26

STRATEGIC CONSIDERATION – DIFFICULT TO QUANTIFY 26

THE SOVEREIGN WEALTH FUND AND ITS MANAGEMENT 27

Expected income *29*

Links with the rest of the economy *30*

Ethical Investments *33*

LESSONS FROM OTHER NATURAL RESOURCES 34

CONCLUDING REMARKS 35

THE ENVIRONMENTAL LENS 38

POLLUTANTS 38

THE DRILLING PROCESS 39

RENEWABLE SOURCES 40

ENVIRONMENTAL BENEFITS AND RISKS OF NATURAL GAS 41

Smog and poor air quality 45
Industrial and Electric Generation Emissions 46
Pollution from the Transportation Sector - Natural Gas Vehicles 48
Implications on Marine Life 49
Preparations to Mitigate Risks 51
Concluding remarks 53

THE REGIONAL LENS 54

Does Natural Gas Create an Incentive for Cooperation among Eastern Mediterranean Countries? 54
Joint projects 58
The view from Washington 59
Delimitation and lessons from international experience 60
Focus on Turkey 61
Legal positions 61
Strategic decisions 63
Impact on the EU – Interests and Future Energy Needs 65
Delivery Options and Possible Corridors - Strategic and Economic Concerns 67
Trends in Global Energy Markets 76
Concluding remarks 77

The Israeli-European Policy Network

The Israeli-European Policy Network (IEPN - www.iepn.org) works under the direction of the Israel Office of the Friedrich-Ebert-Stiftung (FES), and its partners, the MACRO Center for Political Economics, Tel Aviv and the Universität der Bundeswehr in Munich, Germany.

Since 2003 IEPN aims to uphold a continuous, long-term, constructive and critical dialogue between decision-makers, key public figures, academics, journalists and other professional groups from Israel and the EU on pertinent issues in EU-Israeli relations and wider Middle East politics. IEPN focuses on economic, social, political and security issues which are of common interest to both sides and on the potential of increasing Israel's convergence with Europe. What distinguishes IEPN from other organizations engaged in similar issues are not only its multi-layered, flexible structure and its focus on concrete issues, but also its twin anchorage in the EU and in Israel.

The Institute for National Security Studies

The Institute for National Security Studies (INSS – www.inss.org.il), an independent and non-partisan institute, is Israel's leading think tank on issues relating to Israel's national security agenda. Positioned between the more superficial analysis of journalism and the slower-paced analysis of academic research, INSS is committed to encouraging new dynamic ways of thinking, devising creative policy solutions, and expanding the traditional contours of establishment analysis.

INSS sees its policy-oriented research as a means to launch, engage in, and shape the public debate of the leading issues on Israel's national security agenda, identify policy opportunities, and propose creative solutions to the national security challenges facing the State of Israel.

Executive Summary

The natural gas resources that had been discovered offshore in the Eastern Mediterranean are projected to yield massive dividends in the foreseen future. These are expected not only to affect the energy market, but may also be considered a game-changer with economic, environmental, and regional implications.

In June 2013, the Friedrich-Ebert-Stiftung, the Macro Center for Political Economics and the Institute for National Security Studies organized a conference in the framework of the Israeli-European Policy Network titled "Natural Gas in the Eastern Mediterranean: Economic Impacts and Strategic Implications". This booklet is an attempt to summarize and expend upon the topics discussed during the conference. Though they may not necessarily represent the opinions of all the speakers at the conference, the main conclusions are hereby presented:

- Taxation and exportation policies should be determined with the interests of the Israeli public as a top priority. The needs of the Israeli economy should be guaranteed regardless of the export quota determined in committees. This discussion should be held publicly and not behind closed doors.

- A major part of the gas revenue should be routed to a designated interest carrying sovereign wealth fund (SWF), with gradual annual transfers to the budget. Such a fund would be independently managed, and separated from other government agencies, probably without restricting itself to ethical investments.

- The transformation to gas based production and transportation provide great benefits to the Israeli economy, both environmental and economic. However, this kind of transformation is viable only if a sufficiently large and certain gas supply exists.

- The process of exploring for gas and producing carries many environmental dangers. The Ministry of Environmental Protection should be better prepared to deal with these risks, while the producers must adopt the various technological innovations that minimize it.

- The recent gas discoveries in the eastern Mediterranean provide great opportunities to the countries in the area, Israel notwithstanding. There is more than one way to cash in on the gas profits in international relations currency: rehabilitating the relationships with Jordan, Egypt and Turkey by providing them much a needed resource, reaching the European energy market via Turkey, or furthering the cooperation with Cyprus via joint energy projects.

It is clear that natural gas in the region is a complex multi-dimensional issue. The gas discoveries have economic, political, environmental and social implications. While each issue was discussed separately in order to maintain an intelligible structure, throughout the sections it is apparent that the political and economic aspects are all interrelated and demand a cohesive policy. Whether Israel's natural gas realizes its full potential depends entirely on Israel's ability to provide a proper framework along with the countries in the region.

Introduction

Countries that have, until now, been dependent on energy imports are thrust with the opportunity to develop massive gas fields, increase their energy security and even export natural gas to other regions due to the recent findings in the Eastern Mediterranean. The discoveries are expected not only to affect the energy market, but may also be considered a game-changer with geo-strategic, environmental and social implications.

Since natural gas is already showing signs of having dramatic impact on the region and public discourse, the Friedrich-Ebert-Stiftung, the Macro Center for Political Economics and the Institute for National Security Studies organized a conference in the framework of the Israeli-European Policy Network. The conference, titled "Natural Gas in the Eastern Mediterranean: Economic Impacts and Strategic Implications" took place on June 5-6, 2013 in Tel Aviv. It included many international experts from the region and the EU and focused on the different implications of the natural gas findings. This publication summarizes the main conclusions of this conference.

While horizontal drilling and hydraulic fracturing have been used for decades, recent refinements have made the production of natural gas from a number of shale and other geological formations less costly. As a result, exploration and production steadily increased in recent years, with explosive growth in specific regions. Since the 2008-2009 recession, the growth of natural gas production has been regarded by some as a highly positive development as it can increase employment and economic diversification while bringing lower energy prices to consumers. However, many are concerned the production practices used in natural gas extraction pose environmental risks, while others are concerned about the impacts that sudden economic expansion can have on communities.

The first section in this booklet describes the economic considerations that should be in the forefront and the ways they should be addressed when forming policies. These include, among others, export quantities, determining local gas needs, and the management of the sovereign wealth fund. The second section deals with the various environmental implications natural gas production, and how to manage them, as well as the opportunities that arise in the clean energy sector.

The last section discusses the challenges and opportunities these discoveries raise in the regional sphere, as well as presents an overview of the situation of other gas producing countries in the Eastern Mediterranean - where a regional cooperation can be formed, and what obstacles need to be overcome for this to occur.

"The question of the gas discovered in the Eastern Mediterranean has political and security aspects related to Israel's geo-strategic position. Many opportunities, but also optional to confrontations. There are macro-economic implications and there are social aspects regarding the eventual allocation of resources. A policy should be created that is not based exclusively on energy needs, entrepreneur needs, environmental, social or economic needs, but on a model that internalizes and takes into account all of these elements."
Major General (ret.) Amos Yadlin

Recent Developments of Explorations, Findings and Production in the Region

A study by the United States Geological Survey[1] stated in 2010 that the Levantine Basin, which contains the Exclusive Economic Zones (EEZ) of Cyprus, Israel and Lebanon, contains approximately 122 TCF of recoverable gas and 1.7 billion barrels of recoverable oil. In terms of natural gas that puts it roughly at the level of Iraq, which is twelfth in the world.

Only a third of this vast reservoir has been explored, mostly by Israeli efforts, and a small part by Cyprus. The discovery of the Noa field in 1999 and the Mari-B field in 2000 and discoveries in 2009 (Dalit and Tamar), 2010 (Leviathan), and 2011 (Aphrodite and Tanin) by U.S. firm Noble Energy confirmed the presence of significant quantities of natural gas in the Levantine Basin. The geological characteristics of the basin, that are similar all throughout, provide a good indication that future, equally attractive, prospects are in store.

According to the Natural Gas Authority the demand for natural gas in Israel will rise to 16.8 BCM in 2030. This appraisal includes the gradual shift to natural gas by the Israel Electric Corporation (replacing coal) and the population growth and rising quality of life. An average growth of 0.6 BCM per year would mean the available gas reservoirs would last 40 years.

The Ministry of Environmental Protection claims these estimates are, in fact, undershooting. Potentially, the Israel Electric Corporation can utilize more gas than taken into account (50% of Israel's supply). If there was a will, then 70% of Israel's energy could be manufactured from gas. In addition, the estimations did not include Gas to Liquid plants, methanol plants or industrial use. All of these, by 2040, could account for 10, and even up to 20 BCM per year. The ministry calculates that by

[1] Schenk, C.J., Kirschbaum, M.A., Charpentier, R.R., Klett, T.R., Brownfield, M.E., Pitman, J.K., Cook, T.A., and Tennyson, M.E., 2010, Assessment of undiscovered oil and gas resources of the Levantine Basin Province, Eastern Mediterranean: U.S. Geological Survey Fact Sheet 2010-3014, 4 p.

2040, 600 BCM will have already been used. At that rate, 1200 BCM will be used by 2055 – that is the entire reserves believed to be in Israel's economic waters (according to the previously mentioned USGS survey).

The Israeli economy has, in recent years, undergone significant changes in terms of fuels. Within the space of a few years, natural gas has become the primary, preferred fuel for electricity generation and for major industries, yielding savings of 20 billion NIS for the economy, alongside a significant reduction in emissions of pollutants due to the declining use of oil and coal. Vast gas reserves found off the coast of Israel are helping to encourage energy initiatives based on natural gas.

In 2010, Israel consumed 5.3 BCM of natural gas, of which 90% went to electricity generation. Yam Thetis reservoir supplied approximately 60% of consumption, with the remainder supplied by Egyptian gas company, EMG. In 2010, 40% of electricity in Israel was generated from natural gas, leading to savings of 1.4 billion dollars for the economy. By 2015, the rate of natural gas consumption is expected to rise to 50%. At the same time, natural gas production from new reserves will be increased, and the transmission and distribution systems will be upgraded. The transition to natural gas yielded 17 billion dollars savings in 2004-2012 (the alternative cost of building two new coal power plants, that were planned for 2009 and 2011), and also contributed greatly to a reduction in pollutant emissions.

Current Natural Gas Resources in Israel's EEZ

Yam Thetis

Yam Thetis is a partnership of the Delek Group and Noble Energy for drilling operations in accordance with permits and licenses issued to them by the Ministry of Energy and Water Resources. In June 1999, proven natural gas reserves were found in the Noa lease area, followed in February 2000 by more proven natural gas reserves in the Mari lease area. In 2001, following the discovery of the reserves, the Group

started construction of production infrastructures, and as of 2004, began supplying natural gas to Israel Electric Corporation and subsequently also to large industrial enterprises.

In December 2002, the Yam Thetis partnership was granted a transmission license, which consists of the supplier's own transmission system and the on-shore processing facilities, up to the point of the connection to the national transmission system.

The right holders in the Yam Thetis partnership are: Noble Energy (47%), Delek Drilling (25.5%), Avner Oil and Gas Exploration (23%) and Delek Investments and Properties (4.4%).

Yam Thetis reservoir, which served as a primary gas source for the Israeli market is supposed to become completely depleted during 2013.

EMG (Eastern Mediterranean Gas & oil)

In the summer of 2005, the governments of Israel and Egypt signed a memorandum of understanding for the importing of natural gas originating in Egypt to Israel; at the same time, a natural gas purchase agreement was signed between the Israel Electric Corporation and EMG, a joint venture between Egyptian and Israeli companies granted a concession from the government of Egypt to export natural gas to Israel, up to 7 BCM of natural gas per year over a 20-year period.

In December 2006, EMG was granted a transmission license, to supply natural gas from Egypt. Work started on the laying of a submarine pipeline from El Arish in Egypt to a reception facility adjacent to Ashkelon, and as of May 2008, the company has been supplying natural gas to the Israel Electric Corporation and to the Israeli industry. In March 2012 the supply from Egypt stopped due to security reasons and perpetual unrest in Egypt.

The Tamar Reserve

The real change in Israel's perception of natural gas started with Tamar, suggesting the Levantine Basin can be a very prolific source. If exploration (and drilling) continues it is believed to provide even more gas to not just the offshores of Israel but also Cyprus, Lebanon, Egypt and possibly Syria.

The Tamar project is a partnership of Delek Group, Noble Energy and Dor Gas Exploration for drilling operations (figure 1). In 2009, large-scale natural gas reserves were discovered at the Tamar site, approximately 90 km west of the Israeli coast, at a depth of 1,800 meters below the surface of the sea.

The Tamar field is considered a large reserve even in global terms, containing 283 BCM, a quantity equivalent to Israel's total energy consumption over a 10-year period. In April 2013 gas supply from Tamar commenced. Over the next 10 years, the Tamar field will supply between 50% and 80% of Israel's natural gas consumption needs.

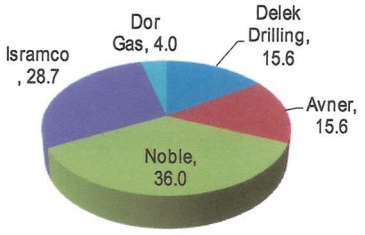


Figure 1: Tamar Ownership

Tamar's development program includes five subsea wells (each 200 to 250 MMCF/d) at a water depth of approximately 1,700m. Gas produced will be gathered at the field and delivered via Dual 16" flowlines. The new Tamar platform is being constructed adjacent to the existing Mari-B structure. The Tamar platform is located 25 km from shore, at 237m water depth, and is tied to the existing 30" pipeline that delivers natural gas to the Ashdod onshore receiving terminal.

Initial processing capacity is currently up to 1.0 BCF/d, and after expansion it is supposed to be 1.5 BCF/d. The project includes gas injection, storage and withdrawal in the Mari-B reservoir. Initial sales commenced on March 31, 2013.

In early April 2013, Delek finalized a $3.5 billion development plan of the Tamar project, set to introduce 1 BCF a day to the local market.

When Wood Mackenzie analyzed all the natural gas discoveries in 2009 from around the world, arranging them by depth of water versus time to market, they produced figure 2, Tamar is in red.

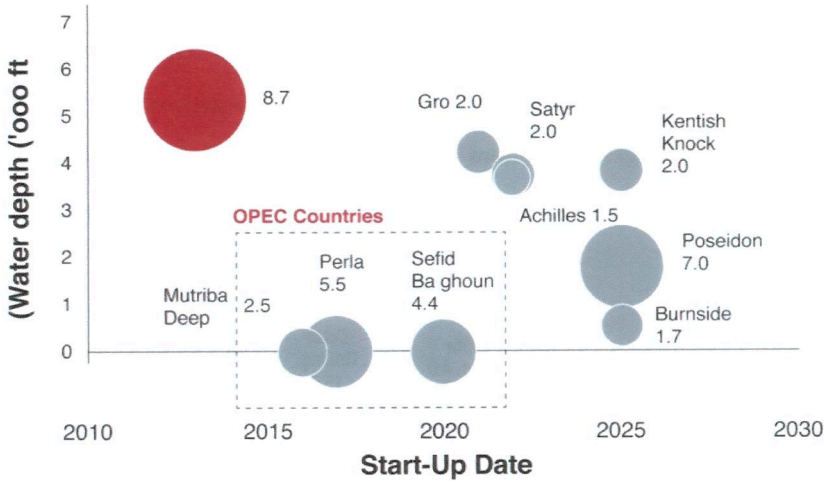


Figure 2: Largest Conventional Gas, 2009

Although Tamar was the deepest in the world that year, the local market was introduced its gas the earliest, in 2013 (the rest will arrive in the markets starting in 2016).

The Dalit Reserve

The Dalit deposit, managed by the same partnership, is located approximately 40 km west of the Israeli coast, at a depth of 1,200 meters, and contains only 7 BCM to 14 BCM.

The Gaza Marine Reserve

The Gaza Marine field is located opposite the Gaza coast and is owned by British Gas (90%) and Consolidated Contractors Company, a Palestinian-Lebanese investment company (10%). According to British Gas's estimate, the reserve contains more than 30 BCM in recoverable resources and is expected to produce 1.6 BCM annually.

In September 2012, the Palestinian Authority and Israel discussed developing the offshore Gaza territory, although no formal agreements are in place.

Imports of LNG (Liquid Natural Gas) to Israel

In order to diversify the energy sources for the economy in general and natural gas in particular, the government of Israel made a decision to build an LNG facility in Israel, as set out in Government Resolutions 2178, 3260 and 177 "to increase the offering of natural gas suppliers to Israel's economy, and to construct a liquid natural gas facility". The facility's construction is intended to free the state from exclusive dependence on imports of natural gas from Egypt, and on the Israeli Yam Thetis field, and to ensure the continued supply of natural gas to the economy if supply from one of the sources is suspended.

In February 2011, the Ministry of Energy and Water Resources announced a plan to build a buoy-based LNG receiving terminal off the Hadera coast. The buoy was built by the government, owned by the Israel Natural Gas Lines Company (INGL), and finished construction in January 2013 with the connection of the LNG vessel to the buoy. Purchasing of the natural gas and ordering of a natural gas tanker to connect up

to the facility and discharge natural gas through it will be undertaken by the Israel Electric Corporation. Industrial enterprises and other consumers will be able to order LNG shipments independently or through joint use of the tanker ordered by Israel Electric Corporation.

The offshore buoy approach was selected because it was found to be the technology capable of facilitating the supply of LNG to Israel as soon as possible, and operating successfully in the USA, Argentina and the Persian Gulf. The promise of constant availability of several natural gas resources is of great strategic and economic importance.

Leviathan

Leviathan is a world-scale discovery, the largest in recent years. It was discovered in November 2010, located roughly 130 kilometers west of Haifa in waters 1,500 meters deep in the Levantine basin. The gas find has the potential to change Israel's foreign relations towards a closer collaboration with Cyprus and with Greece. It is believed to be twice the size of Tamar, 540 BCM (and gross contingent resources estimate is up to 700 BCM). There are already four completed wells.

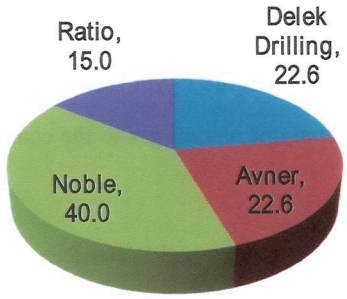


Figure 3: Leviathan Ownership

The policy needed to deal with the major discoveries of gas, has to ensure continuous supply of gas, to be based on continued growth in demand and the economy's transition to natural gas consumption. The highlights of the policy should be securing a steady supply, issuing licenses for infrastructure development, encouraging competition, establishing safety criteria and tariffs, and ensuring consumer protection.

The Economic Lens

Taxing and Extracting Natural Resources

Oil and gas industries generate significant revenues for the national economy. Sound macroeconomic management and governance are required to ensure that the money generated from these projects is invested in local communities through policies that foster economic development and poverty reduction.

While the oil and gas industries provide significant opportunities for developing economies, they also bring substantial risks that need to be managed and mitigated by governments, investors, and communities. The limited nature of oil and gas resources make it particularly important that governments' economic policies ensure that the benefits of their production contribute to the development of the human, social, and physical capital needed for sustainable development and growth.

Unfortunately, in certain cases, neither investment nor oil revenues have been able to guarantee economic growth or poverty reduction. Thus, the presence of major oil and gas industries has been associated with a variety of negative social and environmental outcomes. The so-called "paradox of plenty," where resource development fails to generate the sustainable benefits expected, is one of the most urgent challenges.

To improve the governance and revenue management of extractive industries, the following key policies are critical:

- The establishment of transparency and accountability with respect to revenues earned and their disposition.
- Consultation with principal stakeholders in developing plans for the use of resource revenues to invest in development and poverty reduction.
- Credible oversight and audit of the implementation of these plans.
- Serious attention to building local institutional capacity.

There is a need to comprehensively address both environmental and social impacts of hydrocarbon development. Properly managed, oil and gas operations can be expected to provide major benefits to the communities in which they take place. Some potential benefits include: increased local employment, the transfer of technical and commercial skills and development of local capacity; a share in fiscal revenues at the local level; enhancement of local social infrastructure and improvement in the delivery of services, especially in areas such as health, education, transport and power as a result of increased public funds and investor contributions; and positive multiplier effects in and beyond the communities in which the extractive operations exist.

In the question of ownership on the means of gas and oil production, different countries have chosen different paths. For example, Norway founded a government owned company, 'Statoil', to participate in the oil and later the gas industry, which eventually became partly privatized in 2001 with the state as its majority shareholder. Israel chose to let private investors, companies, and private equity (legally) use natural resources to obtain revenue.

This choice may have been made partly due to the fact that the state of Israel did not have the technical ability to produce revenues from deep water gas. It has been technologically and economically infeasible for many years, but with rising oil prices, more companies are choosing to invest in this area.

Drawing conclusions from the Norwegian Government Pension fund, a system for the government to participate in the economic dividend from the discoveries, whether by direct participation, taxes, direct dividends, royalties or other means needs to be provided. Higher government revenues require taking greater risks. And obviously, low risk tends to yield lower returns over time. This is a central policy variable for any country with natural resources.

Tzemach Committee - Recommended Export Quantities and the Government Decision

The committee tasked with drafting a national policy on Israel's newly discovered natural gas reserves decided to allow the gas producers to export even more than they requested, according to the protocols released in June 2013. The protocols of the Tzemach committee span more than 2,000 pages, and cover 17 meetings that took place over nine months.

One of the more noteworthy discussions is centered on how much gas to export. While the gas companies had said they would need to be permitted to export 300-350 BCM of gas in order to fund their export facilities, the committee ultimately called for allowing the export of 500 BCM of gas, while reserving only 450 for Israel's own uses – even though the committee did not have figures stating that Israel actually had those amounts of gas in possession or in theory.

The explorers and investors own the gas in one very important sense. If they do not invest the billions of dollars in infrastructure needed to transport, process and possibly liquefy the gas, it is worth nothing to anyone. Therefore they are demanding, and will probably receive, sufficient profits to justify their investment, right off the top.

The Ministry of Environmental Protection's position is that the basis for the discussion regarding gas export should rely on professional analysis and estimation, abstaining as much as possible from political gains. After determining what Israel's needs are, it is logical that the rest can be exported. Understandably, entrepreneurs that chose to invest and develop Israel's gas resource have to be assured of their ability to eventually export in order to raise the proper funds needed to continue developing these reservoirs. The underlying motivation is, of course, that big investments tend to yield big rewards.

The question arises, were the recommendations made by the Tzemach Committee considering Israeli needs first and foremost. The Israel Energy Forum views them as predominantly ensuring the best interest of the oil and gas companies, with far less concern to the interest of the public and the environment, as well as long term planning.

Seen in that light, committee discussions seemed to have taken into account the threat of the companies claiming that the Leviathan reservoir will not be developed unless export is allowed and that was looming above many decisions. The Forum's position is that the committee's focus should have been concerned with the implications of saving gas for a certain amount of time as opposed to exporting, especially bearing in mind the public's interest, not the developers'.

Arguments For and Against Larger Export Quotas

Israel's leading environmental groups have launched a campaign to get the Knesset to reject the recommendations of the government-appointed Tzemach committee on gas exports. The environmental organizations stressed that the gas is predominantly a natural resource that belongs to the public and should therefore benefit the local economy by lowering prices, reducing pollution and making Israel totally energy independent. These organizations appealed to the Israeli High Court of Justice to demand a Knesset decision on the matter. This appeal was rejected by the court at the end of October 2013, paving the way towards implementation of the cabinet's previous decision on the matter.

The cabinet's decision to export around 40% of the newly found gas and preserve 60% of the gas for local use was made earlier on the 23rd of June this year. The decision dictates that sales to Israel's immediate neighbors, Jordan and the Palestinian authority would come out of the allocation for exports. The decision attempted to find a compromise between the recommendations of the Tzemach committee to export half of the gas on one hand, and the concerns of the public and some of the political

organizations to ensure Israel had enough gas to become and remain energy self-sufficient for years and years to come on the other hand. The conservative approach reflected Israel's long history of energy dependence, relying mainly on Egypt for natural gas supplies and suffering from numerous disruptions due to attacks on the pipeline connecting the countries.

"We should determine the needs of the Israeli economy and export what is left. We realize that in order for entrepreneurs to raise the required funds to continue and develop the discovered reservoirs, they should have some sort of certainty in regard of export, because of their immense investment. Still, big investments - big profits."
MK Amir Peretz

Between keeping all the gas for local purposes and exporting a large proportion, a balance had to be found. Oil and gas companies involved in the development of Israel's hydrocarbon wealth need an incentive to continue their search for gas and to transform the country into an energy producer. Sales revenues would ensure such a motivation is maintained and would constitute a serious incentive for oil and gas explorations to go on. New revenues would also substantially boost the country's economy by improving the employment market, allowing the realization of national projects of all kinds and constituting a hedge against balance of payment fluctuations.

The Australian company Woodside has signed last December a memorandum of understanding with Noble, Delek, Avner Oil and Gas and Ratio Oil Exploration to acquire 30 percent of the Leviathan field. The terms – $696 million upfront, $200 million once Israel passes laws permitting LNG (liquid natural gas) exports, and a further $350 million once the Leviathan consortium approves an LNG operation. This would provide some of the crucial funds required for building the infrastructure. Turning natural gas into liquid so it can be transported by ship is very costly. Nobody

knows whether the decision to cut gas exports from half to 40 percent will endanger the Woodside investment by reducing its profitability and lengthening the payback period.

The previous uncertainty around the outcome of the appeal frustrated investors and in particular the Australian giant Woodside - the deal had been due to close in February but was delayed on several occasions, initially pending a government decision on gas exports, and then by the Supreme Court's consideration of appeals against it.

Investors - Principle and Economic Arguments

A major concern is that if the commercial opportunities offered are not perceived as good enough, companies may prefer looking for gas in places with more lucrative ones like Cyprus or Lebanon. The Ministry of Environmental Protection's position regarding the entrepreneurs' warning of abandoning Leviathan if the exporting caps aren't enlarged is that the threat is unfounded, since the area's potential is so great compared to the investment.

It is difficult to determine the truth behind entrepreneurs' arguments or tell exactly whether any opportunities were missed because entrepreneurs didn't consider the conditions right for investment. However, the chairman of Noble Energy, Charles Davidson, has previously said that "This is still one of the best sights we have in the world. We are happy after the committee. We thought we'll have 25% return, you left us with 18%. We're sad but it's ok. We're fine."

It is worth mentioning that although the 1952 law allows three sites for each company, Delek and Noble Energy have more than 20, making them a monopoly on all the Israeli sites. The law also states that if there is a discovery, a 30 year permit can be allotted (and later on extended by 20 more years). Therefore, new companies will have a hard time entering the market. Nobel Energy admits that there are other firms

seeking opportunities to find gas, but claims they are waiting for the right policy to be enacted.

Nobel Energy claims to be committed to the Israeli market and government. Their assumption is that no profit for the Israeli state and public can be made while the gas remains in the ground. Exporting the gas is harder and more expensive than selling it in the domestic market. Their suggestion is for Israel to diversify its gas sources and to keep all options open.

In Delek's viewpoint, the full potential of the gas field can only be fulfilled if exploration continues, and in order for that to happen there should be a market for gas, which makes export necessary. A more professional analysis should be held to fully estimate the needed policy.

Comparisons to Other Countries

Other countries that have encountered various successes appropriately handling gas and oil discovery provide valuable lessons. But when comparing Israel's situation to theirs, it is important to identify whether there is a basis for comparison.

The Ministry of Environmental Protection views taking lessons from Norway and Canada regarding gas as unjustified: both rely on large coal and oil reserves or renewable resources as their main source of energy. Having alternatives to rely on, they can afford to export. Israel's situation is different because there are no alternatives other than importing coal and gas, so exporting the discovered gas is not a foregone conclusion.

According to Nobel energy, however, the reserves of countries like Australia and Norway grow because they export which, as mentioned earlier, encourages exploring for more gas. The opposite examples are Bangladesh and Egypt, which were left with shortages of gas due to lack of investments and development that are a byproduct of export.

The Israeli Energy Forum, however, puts the blame of the situation in Egypt on the Egyptian government's decision to allow the exaggerated export of gas, resulting in the country importing expensive gas for local consumption while under contractual obligation to export cheaply. Another example of this phenomenon is prevalent in the United Kingdom; having depleted its natural gas reserves by exporting vast amounts, it now relies on imports bought at much higher rates.

The Public Discussion and Political Aspect of the Export Decision

There is a lively public discussion in the last few years regarding the natural gas discoveries. One result of this discussion was the revealing of the Tzemach Committee protocols. They were revealed thanks to public pressure and a court appeal.

It was suggested that public discourse has become a bit emotional instead of factual. Some, like professor Sheshinski, think the decision on the suitable export quota should be made regardless of the protests and only factor the state's discount rate, the risks and the price of gas.

"There has been a vigorous debate around the gas discoveries over the past few years, some of it concerns environmental protection. Several environmental organizations are involved in this discussion, some of which are involved in a way unrelated to their expertise. There is a feeling that public discussion have become wild, emotional and not always founded on facts."
Sagi Karni

Then again, with gas reservoirs being public property, it is important that any policy concerning them would be open to public criticism and discussion. The government, being elected by the public, may be qualified to make decision in its name, but its

electability is not enough to ensure that it acts in the public's best interest. For that to occur, some form of regulation is needed, in the form of decision making transparency and a supervision of the Knesset. These elements were absent in the process that led to the decision to export 40% of the natural gas.

Discount Rate and Horizon

The Tzemach committee based its decision on an outlook of 25 years. This number may be an approximation and somewhat arbitrary, according to previous statements made by Morris Dorfman and Shaul Tzemach.

The system of considerations regarded by the state is considerably different than the one standing in front of a private investor making a similar plan. Where investors are concerned only with potential profits or stocks' value, the state must consider values that are harder to monetize, such as social welfare and effects on the environment. In economic theory terms, it can be said that that inventors may use a different discount rate than that of the state.

There are two opposing considerations when determining this number. Long term planning of policy is important, especially if one intends to share gas revenues with future generations. Conversely, it may be hard to determine the situation behind a certain horizon and this may lead to mistakes in planning.

Macro Center's suggestion is that a distinction must to be made between using resources that are disposable and those that are renewable. Disposable resources can't be allocated to ongoing uses. Once the source is gone, a rollback will occur – hurting and decreasing welfare.

Needs and Expected Income

One of the tasks the Tzemach committee was assigned was determining the amount of gas the Israeli economy would require in the next 25 years. A different approach was

suggested by the Ministry of Environmental Protection. While both the committee and the Ministry of Environmental Protection agree that in order to steer clear of oil and coal and produce electricity only from gas, 300 BCM of gas are needed over the course of the next 25 years.

Large and medium industries were issued by the committee 110 BCM allocated in order to transition to gas usage. The Ministry of Environmental Protection's suggestion adds 20-30 more BCM of gas for this sector, in favor of new enterprises and industries. Unoccupied resources can increase the motivation for entrepreneurs, while limiting the gas to existent industries will also limit that motivation. Gas use can cut production costs in many sectors, thus increasing their competitiveness in global markets.

The Tzemach committee allocated 40 BCM of natural gas to Israeli transportation. Transportation is a major air polluter and transitioning it from gasoline to gas can have major positive environmental implications. Private transportation can cut private expanses on fuel by converting to gas. The Ministry of Environmental Protection is interested in allocating 150-200 BCM to transportation in order to achieve this.

The Tzemach committee estimates the Israeli market requires 450 BCM in the next 25 years. This is an underestimation compared to about 600 BCM suggested by the Ministry of Environmental Protection.

Keeping a larger amount of gas as reserves for the Israeli economy instead of exporting it has a considerable cost: with less export, the benefits from the export revenues are much smaller. But do the additional export revenues benefit Israel as greatly as using the gas in the local market would?

The Israel Energy Forum claims it does not. Without the majority of the gas sold to Israel and with a further horizon than 20 years, transforming the Israeli economy to gas dependent production will be neither manageable, nor profitable. This

transformation, however, can be more profitable than the revenues from exporting. The gains to the Israeli economy from transitioning to gas in industry and transportation were estimated at about $200 billion by the Israeli Institute for Economic Planning. Deprived of this transition, Israel will have to rely on expensive oil and coal while exporting gas.

Risks, Diversification and Israel's Energy Security

As mentioned before, exploration for gas and its production require risk taking, both by the state and the entrepreneurs. One way to minimize risks is by diversification.

Some risks derive from uncertainty. During most of its years the Israeli government was the one to negotiate market price for energy sources, and even during the Arab boycott has never faced an energy problem. Nowadays, price is mostly dictated by the market itself, with a very small role for the government. It is impossible to predict future prices.

It was suggested by Professor Sheshinski that in order to minimize risks for the state, Israel should build a second pipeline from Leviathan by 2017-2018. To minimize business risks, he believes entrepreneurs will demand a minimal quota of 300 BCM to financially secure Leviathan.

Delek Drilling supports diversification as means to give Israel the flexibility to supply to the local market and to be able to choose the best export project. This kind of flexibility can shorten the time spent until the company is able to market the gas.

Strategic Consideration – Difficult to Quantify

The relationships between Israel and its neighbors and possibly other countries may also be affected by the exportation of gas. While difficult to price and quantify, this effect should be taken into consideration.

One example is the relationship with Jordan. Jordan, like Israel, has also suffered attacks on its gas pipe in Sinai. Both may have a common interest in protecting the pipelines and ensuring their security. Israel has obvious strategic reasons to support Jordan's inner stability, which may be challenged by the developments in the Middle East, especially regarding the Syrian refugees it received. Therefore, the Institute for National Security Studies suggests that Israel should connect Jordan to the new gas supply, in a similar fashion to the way Israel has supplied it with water since 1994.

The Sovereign Wealth Fund and its Management

Misuse of the large government revenues from gas and oil can have adverse effects on the economy. Consumed all at once, it can lead to real appreciation of the national coin, which would lead to the loss of export competitiveness, ending in slow growth and unemployment. This process is known as the Dutch Disease, named after the Netherlands's experience with natural resources revenues.

"Spending oil revenues has a different macro-economic effect [than] spending other types of money. If the government spends a dollar, but penances that dollar by taxing its economy, it pulls one dollar of purchasing power out of the economy for every dollar it puts in. Oil revenue doesn't have that effect. It just has an expansionary effect that doesn't contract the main land or non-oil economy, and this is exactly the reason for the Dutch Disease phenomenon."
Martin Skancke

Dutch Disease, however, is not the only pitfall when dealing with these revenues, only the most famous one. Other pitfalls include bad or short sighted investment due to political reasons, loss of focus on other production sectors and rent-seeking activities along with increased risk of corruption. Some of these risks occur due to the nature of gas and oil revenues: the income rises from the depletion of the "asset" (meaning, the

gas field), the amount of production and profit are under great uncertainty, and the apparent ease makes the revenues look like "free money".

Instead of being used all at the same time, these profits can be "smoothed" over the years, with fixed amounts added to the state budget each year from an interest carrying sovereign wealth fund (SWF). This method minimizes risks, as well as prevents real appreciation of the national coin. Preventing hasty or unwise investment requires this fund to be independent, as well as transparent and given to public supervision. Investment goals and strategies should be, of course, well-defined. The income and spending of revenues are to be separated. Meanwhile, non-gas economy should not be hindered and long term fiscal frame should integrate gas revenues.

The Bank of Israel recommends creating an investment committee, with actual day to day management in the Bank of Israel, but separated from the foreign currency reserves. Only the windfall taxes will go to the SWF, with other taxes and royalties treated normally and going to the state budget. It is important to complete legislation before the revenues start materializing because their availability will strengthen the incentive to use them directly.

The suggested fund, which will hold state revenues from taxing profits generated by oil and gas companies, the so-called Sheshinski Tax, will begin to operate when 2 billion NIS in taxes are accumulated. The fund will initially remit 3.5% of its assets to the Finance Ministry each year. The estimated size of the fund can be seen in figure 4.

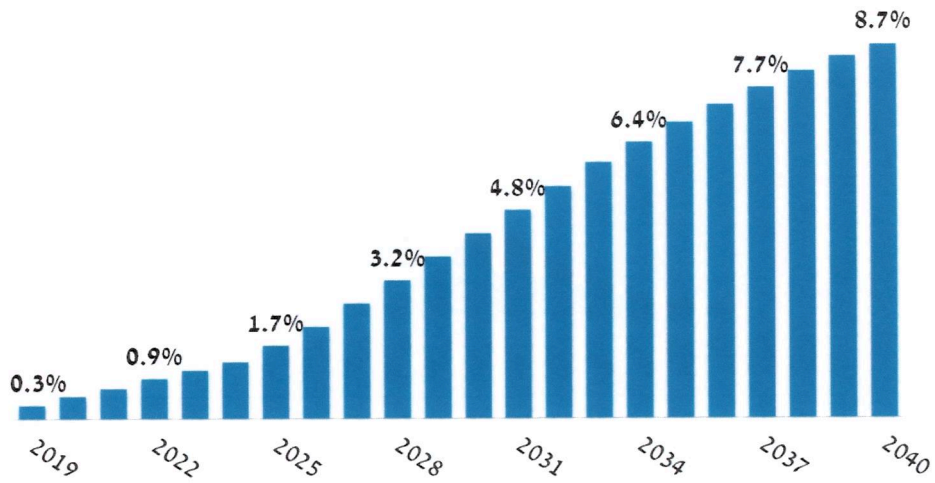


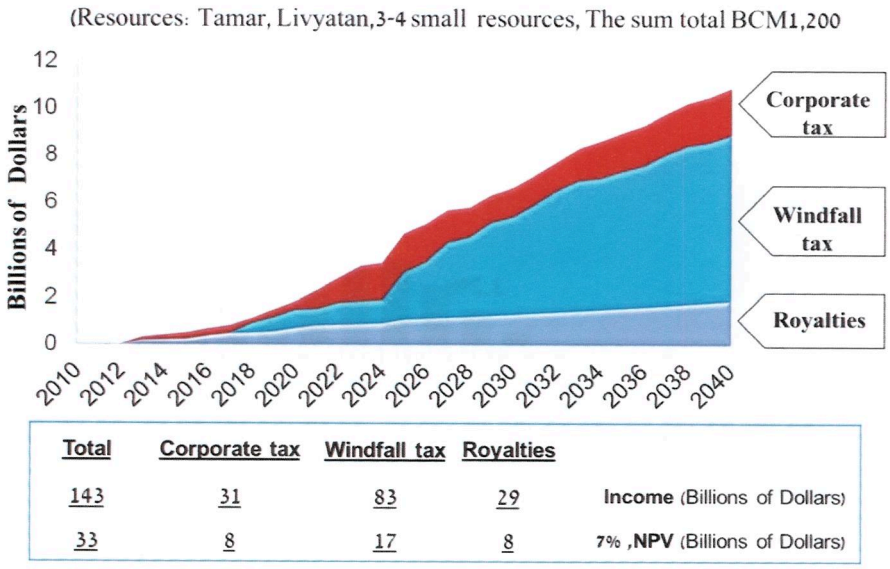
Figure 4: Estimated Size of Fund, as Percentage of GDP

The inter-ministerial panel to formulate the fund's activities, which hasn't yet been formed, will submit its recommendations by the beginning of May 2014. The fund is expected to accumulate 50-70 billion NIS over the next 25 years.

Alternatively, the large military spending in Israel, which manifests in low civilian spending and a high tax burden, may justify the more immediate use of a considerable part of the revenues for health, education and the like, instead of investing them.

Expected income

There is a lot of uncertainty regarding the income of the fund. The Bank of Israel estimates that given the suggestion that only windfall tax shall go to the SWF and the repayment of costs and capita, the SWF will only begin to accumulate in 2018, coming to a more significant rate of accumulation in 2024 (Figure 5). The fund's relative size is estimated to be about 8.7% of the GDP in 2040.



Total	Corporate tax	Windfall tax	Royalties	
143	31	83	29	**Income** (Billions of Dollars)
33	8	17	8	7% ,**NPV** (Billions of Dollars)

Figure 5: Estimated Income from Gas Resources

Links with the rest of the economy

Such funds as those discussed here would undoubtedly interact with the economy. The Norwegian petroleum funds can serve as a good example. The petroleum industry generates demand in the non-petroleum part of the economy directly by the demands of equipment and machinery and indirectly by the tax revenues flowing to the fund and from there to finance government expenditures, which affect the economy. This last effect is controlled and smoothed by the SWF's policy. The oil sector also creates foreign currency revenue, which is re-invested in assets outside of Norway once it reaches the fund and, thus recycling foreign currency inflows and helping to alleviate the pressure on the currency. These interactions can be viewed in figure 6.

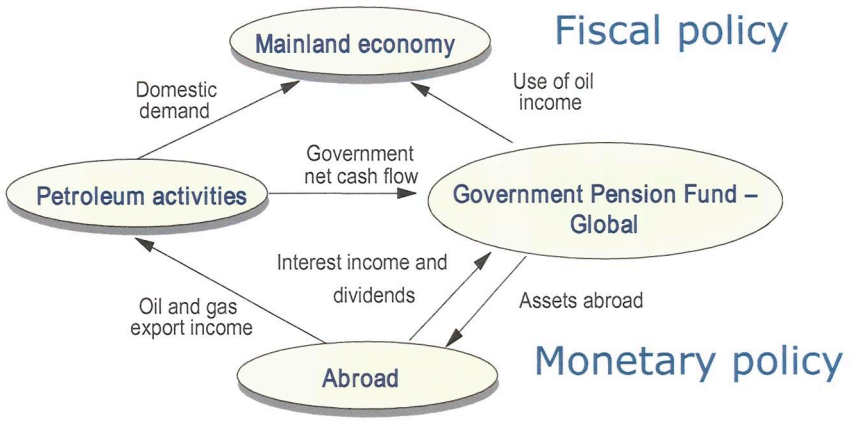


Figure 6: Interactions of the petroleum sector, the fund and the mainland economy

In figure 6, fiscal policy regulates the interactions in the top triangle, while monetary policy regulates the bottom one. The fund's structure links together those two aspects of economic policy.

The type of fund presented here is named a financing fund, meaning it is fully indicated with the budget. The budget takes into account the oil revenues, which are transferred to the fund. When these are taken away a deficit is left, called the non-oil budget deficit. Some of the revenues are then transferred back from the fund to the budget, exactly the amount needed to cover that non-oil budget deficit. This process is depicted in figure 7.

The general rule for the amounts to be taken from the fund is estimating a real return on the fund, at 4%, and taking those 4% out of the fund. This preserves the fund's capital indefinitely.

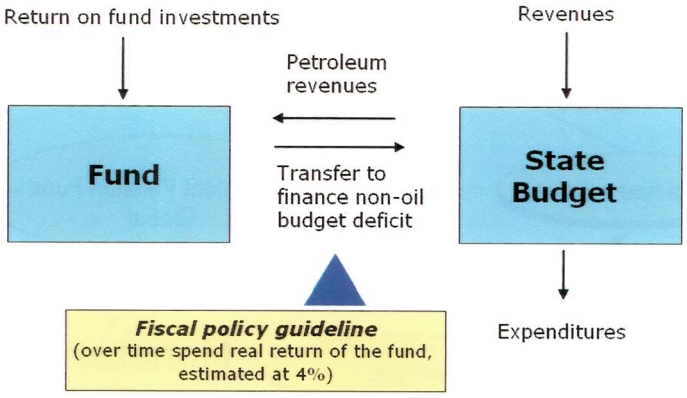


Figure 7: The fund's mechanism – integrated with fiscal policy

While the Norwegian Ministry of Finance is legally responsible for managing the Norwegian fund, its mandate is given to the central bank with general guidelines to follow. The bank manages the fund on behalf of the ministry, using a separate fund management entity meant for assets. This entity then gives the money to internal and external managers. Inherently in the system, the ability to take risks is delegated and supervisory bodies exist at each level. Risks and returns are reported up the chain.

Establishing a sovereign wealth fund is not a policy in and of itself, but a tool to support fiscal policy. It is important to establish a good long term fiscal policy framework and manage it. As mentioned previously, this policy should focus on non-gas, non-oil economy and on human capital.

The risk level taken is ultimately a political decision, but not all politicians have a comprehensive enough understanding of economic risks. From the Norwegian experience, the required approach is that economists should give elected politicians a menu of choices, combinations of risk and expected return that they can choose from. These should be explained in a plain way.

Ethical Investments

Some financial entities adopt an investment strategy that considers both financial return and social good. Such a strategy is called an ethical investment or socially responsible investing. The Government Pension Fund of Norway is an example of a government controlled fund which is mandated to avoid "investments which constitute an unacceptable risk that the Fund may contribute to unethical acts or omissions, such as violations of fundamental humanitarian principles, serious violations of human rights, gross corruption or severe environmental damages"[2].

The socially conscious goals of some sovereign wealth funds has stirred debate about the wisdom of mixing ethical investment with wealth maximization goals, and attempting to influence corporate social and environmental behavior. Sovereign wealth funds share several characteristics which might lead them to invest in sustainable development more than private sector financiers. Their ownership or control by a state can enmesh them in the machinery of government, and thereby render them instruments of public policy. Further, because of their sheer size and government backing, sovereign wealth funds tend to have higher risk tolerances and might therefore bear investment strategies avoided by private financiers. In addition, sovereign wealth funds tend to have longer-term financial considerations than the private sector, which may encourage investing that is mindful of threats such as climate change.

Ethical investment by sovereign wealth funds is controversial. Some observers believe that investment should be based only on economic and financial grounds and, especially in the case of sovereign wealth funds, there is further concern that socially responsible investment could be a means for sponsoring states to insinuate their social and environmental policies globally.

---

[2] "Ethical Guidelines for the Government Pension Fund — Global". Archived from the original on 3 September 2007. Retrieved 19 September 2013.

The Ministry of Environmental Protection has adopted the Bank of Israel's standpoint that the proposed fund has to do what is best for its insurers, and steer away from labeling investments as ethical. The principles of investing the funds overseas and accumulating capital for the next generations, however, can be seen as fairness toward the non-gas economy and the future generations. Setting ethical limitations may become a double-edged sword, since in some countries Israeli companies are already in greater danger to be labeled as unethical.

Lessons from Other Natural Resources

Decisions regarding natural gas may have implications on the status of other natural resources, many of which are arguably privatized public goods as well.

One might compare the gas with other natural resources, such as potash. The potash in Israel is produced by evaporation pools, a method considered cheaper and more efficient than mining, which is the most common method around the world. Potash producer Dead Sea Works, once a government owned company, was partly privatized in 1995 by selling a share to the Eisenberg group. In 1999 it became completely privatized by transferring control to the Ofer brothers through Israel Chemicals.

As the years went by, salt harvesting evolved into an issue with the Dead Sea hotels. It developed up to the point where moving the hotels was considered, but ultimately it was decided to harvest the salt, with the great majority of the cost funded by the Ofer brothers' Israel Corporation and with the royalties being increased from 5% to 10%. An arbitration regarding the royalties and transfer pricing is still going on between the state and Israel Chemicals.

Bottled water can also be seen as a natural resource whose production rights were given to the private sector. Entrepreneurs in this situation may act as though their production permit makes them the owners, while the true owner is the public, through the government. Production rights were given but that does not prevent the

government from making fiscal policy decisions. This fundamental understanding needs to be applied to the natural gas resources as well.

"The common denominator is the right to produce incomes from publicly owned natural resources was given as concessions, sometimes without pricing. The main question that arises is 'what is the appropriate share the government should receive on the basis of its ownership of said resource?' Entrepreneurs inquire 'Do these concessions not make us the owners?' the answer is an unambiguous 'no'."
Prof. Eytan Sheshinski

A policy maker decision based on the view that the true owner is the public and concerning natural gas production can thus set a precedent to the treatment of other natural resources in Israel, and shift public opinion in this direction.

Concluding Remarks

When conducting a policy concerning a new found natural resource, specifically a non-renewable energy source such as natural gas, several main issues come to mind:

- What is the horizon set for policy planning? While it is important to have a long term outlook, the further ahead one plans, the more uncertainty grows and the long term policy becomes less accurate and less meaningful.
- Should the exploration, production or marketing be operated by a government-owned firm or by private investors? The State of Israel may not be able or willing to deal directly with the technical challenge or the financial risk taken.
- How should this resource be taxed? While high tax revenues can contribute to the public spending, high taxes may dissuade some investors from focusing on gas production in the first place.

- What proportion should be kept for the local market's use and how much should be exported? While the exporting of gas would generate high revenues and can potentially be the catalyst for regional cooperation between Israel and its neighbors, the Israeli economy can only fully enjoy the financial and ecological advantages of transitioning to natural gas based production and transportation by maintaining a large local reserve.

- How and when should the gas revenues be spent? Pouring these revenues directly to the state's budget is known to be more of a curse than a blessing, as seen in the case of the Netherlands and the famous "Dutch Disease". A possible solution is containing these incomes in a designated interest carrying sovereign wealth fund (SWF), with gradual annual transfers to the budget.

- How should the SWF be managed? Norwegian experience and Bank of Israel's position indicate that such a fund should be independently managed, and separated from other government agencies, with delegation of the ability to take risks and with supervisory bodies at each level. Risks and returns would be reported up the chain.

- Which considerations should guide fund managers when making investments? It is generally agreed that the investments made by the sovereign wealth fund should be made in a way that maximizes its returns. Additionally, long term considerations dictate that these investments should focus on the non-gas sectors of the economy and keeping the benefit of future generations in mind. The amount of risk taken is ultimately a political decision, but should be made by well-informed politicians, given a menu of options by economists. Israeli policy makers mostly discourage the so called "ethical investment" and would rather not restrict the fund in that manner.

Only the successful resolve of these issues can enable the consolidation of a prosperous and advantageous natural gas policy.

"Non-renewable resources should not be utilized for purposes which are not singular, requiring constant funding, such as directly raising living standards, funding education or health. What would you do the moment these sources run out? Will you cut down spending on health, education or living standards?"
Dr. Roby Nathanson

The Environmental Lens

One of the major concerns that should be addressed when formulating environmental policy is that knowledge in the relevant fields of ecological and environmental sciences has either not been accumulated yet or has not been sufficiently communicated to decision makers. This can lead to decisions being made based on weak scientific ground and presumably taking risks that might cause irreversible negative environmental consequences and that may hold back the development of potential energy or resources. Communicating relevant scientific evidence to decision makers is very critical, and is chief amongst the responsibilities of the Ministry of Environmental Protection.

Pollutants

Another concern is the fact that during the conversion of energy sources into electricity and fuels, pollutants are being emitted and are bound to reach the population. The types and quantities of these vary between energy sources, but all fossil fuels emit CO_2, natural gas not excluded, as is shown in figure 8.

The amount of CO_2 produced when a fuel is burned is a function of the carbon content of the fuel, primarily the carbon (C) and hydrogen (H) content of the fuel. Because natural gas is primarily methane, or CH_4, it has relatively high energy content in comparison to other fuels, and thus a relatively low CO_2 to energy content. Water and various elements such as sulfur and non-combustible elements in some fuels reduce their heating values and increase their CO_2 to heat contents. Some fuels also contain elements that result in the emission of poisonous chemical compounds or particles, such as NO_2, SO_2, smog and lead. Natural gas produces far lower amounts of the first three than other hydrocarbon fuels and does not contain lead and other heavy metals.

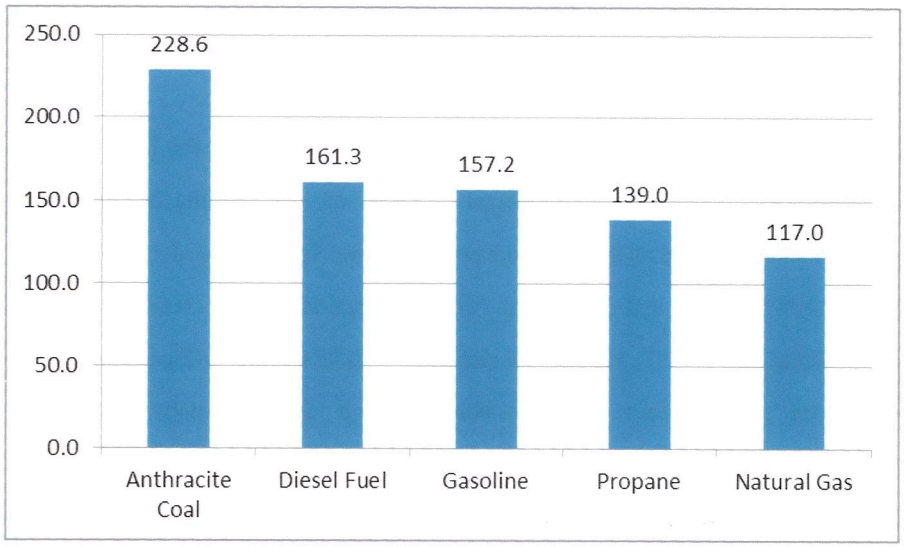


Figure 8: Pounds of CO_2 emitted per million Btu of energy for various fuels[3]

Climate change caused by the emission of greenhouse gas can bring water shortages, which reduce the ability to produce energy based on hydropower and increasing the dependency on fuels, and heat waves that increase the use of air conditioning, which in itself brings more usage of electrical energy and thus more CO_2 emission. These two effects are examples of the interaction between climate change and energy production, an interaction that leads to a vicious circle.

The Drilling Process

An environmental risk of a different kind appears while drilling for gas or oil. While new drilling rigs arrive in the Mediterranean to search for new gas or new oil, Israel lacks the knowhow, the equipment, the control systems and the emergency plans for handling mishaps or accidents, whether big or small. The prevention of such accidents should be in the forefront of any further development in this industry. Even a leak that is 10% of that in the Gulf of Mexico is enough to destroy the Israeli beaches, and have

[3] Source: U.S. Energy Information Administration at www.eia.gov/tools/faqs/faq.cfm?id=73&t=11, last updated on 4.3.13, accessed on 24.9.2013.

a tremendous effect on the marine wildlife. Israel has a lot to learn from previous experience of others in preparing for disasters, such as Europe.

A 2011 report prepared by "Adam Teva V'Din – Israel Union for Environmental Defense" regarding the environmental impacts of gas drilling estimates the environmental damage of the gas production from the Tamar field alone at about 45 million NIS per year, and suggests an "environmental tax" to be created in order to internalized this effect[4]. Among the damages caused by the drilling process and mentioned in the report are the noises, which can potentially disturb the communication and navigation of aquatic mammals, seismic surveys than lead to a decrease in the abundance of fish in the area, the emission pollutants during production, and sludge.

Israel does not have any regulation concerning the protection of the environment and safety when it comes to the offshore industry. There is an opportunity to collaborate with the European community and amongst the region on the matter. Currently, the Ministry of Environmental Protection does not have the capacity to deal with such events. The gaps between Israel and other countries facing similar challenges are substantial, and cannot be closed in the short term.

Renewable Sources

Another shortcoming of conventional fuels is that they are not renewable. With or without gas, Israel's energy policy should be increasing the use of renewable energy sources as much as possible and is feasible. Natural gas is cleaner, but it is still a non-renewable fossil fuel.

The primary renewable energy sources are solar and wind, which are incidental. Lack of proper accumulation solutions prevent the market from relying on them for more

[4] Becker, N. Ben-Slomo, V., Venger, A., and Tabachnik, D. (2011) "*Adam Teva V'Din Report: Envinromental Effects of Gas Drilling, the Tamar Reservoir as a Case Study*".

than 10% of its energy demands. Their other major disadvantage is their need for vast spaces, a resource that is in constant shortage in Israel. Renewable sources can supply approximately 75 TWh per year, when these estimations are not predicted to change in the near future. If the accumulation challenges are somehow mitigated, renewable sources will still not be able to supply more than 30% of the market's demands. This further strengthens the need for and reliance on natural gas, until there is a true technological breakthrough.

The Ministry of Environmental Protection has witnessed a worrisome trend during the last five to eight years - a drop in the will of the market to invest in renewable energy. This may be due to the new energy market prices, affected by the gas discoveries; renewable energy seems less economically feasible. The ministry's standpoint is that renewable energy sources are still necessary and are an important investment. The energy market should be diverse with alternative sources and energy investment policy should consider the entire picture and not just the economic aspects.

In the matter of considering the environment's needs while producing gas, the ministry is obliged to protect it and see to its interests; much like seeing to the interests of the weak.

Environmental Benefits and Risks of Natural Gas

The process of getting natural gas from underground to the end user has the potential for being environmentally destructive. Because of this, there is a dire need for initiatives that help to mitigate the impact of natural gas production, transportation, and distribution.

Technological innovations in the fields of exploration and production of natural gas can lessen the effect on the environment. More efficient exploration and extraction techniques lead to the need for fewer wells to produce the same amount of natural gas. Since drilling operations have an impact on environment both onshore and offshore,

fewer wells mean less environmental degradation. Energy efficient drilling and production methods decrease the emissions of air pollutants, including greenhouse gases, reduce leaks and spills both onshore and offshore, protect ground water from contamination, and reduce the risk of blowouts.

"Gas is cleaner, [but] it's still a fossil fuel and it's cleaner than coal, it's cleaner than oil, but it's still non-renewable and we see it, and I think a lot of people in Israel see it, as the transition fuel towards the next generation of energy, which is still not a hundred percent applicable today."
Yael Cohen-Faran

Smaller drilling rigs decrease the surface impact of drilling for natural gas. Directional and horizontal drilling allow for less surface impact as a greater number of wells may be drilled from a single location, and drilling rig placement is more flexible.

Many specific technologies allow the natural gas industry to obtain more natural gas per well drilled, and lessen the impact on the environment from drilling. New processing technologies allow for fewer emissions and less risk of leaks and spills which may also adversely affect the environment.

Natural gas is an extremely important source of energy for reducing pollution and maintaining a clean and healthy environment. In addition to being a domestically abundant and secure source of energy, the use of natural gas also offers a number of environmental benefits over other sources of energy, particularly other fossil fuels.

Natural gas is the cleanest of all the fossil fuels, as evidenced in table 1. Composed primarily of methane, the main products of the combustion of natural gas are carbon dioxide and water vapor, the same compounds we exhale when we breathe. Coal and oil are composed of much more complex molecules, with a higher carbon ratio and

higher nitrogen and sulfur contents. This means that when combusted, coal and oil release higher levels of harmful emissions, including a higher ratio of carbon emissions, nitrogen oxides (NO_x), and sulfur dioxide (SO_2). Coal and fuel oil also release ash particles into the environment, substances that do not burn but instead are carried into the atmosphere and contribute to pollution. Alternatively, the combustion of natural gas releases very small amounts of sulfur dioxide and nitrogen oxides, virtually no ash or particulate matter, and lower levels of carbon dioxide, carbon monoxide, and other reactive hydrocarbons.

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Table 1: Fossil Fuel Emission Levels - Pounds per Billion Btu of Energy Input

Source: EIA - Natural Gas Issues and Trends

Natural gas, as the cleanest of the fossil fuels, can be used in many ways to help reduce the emissions of pollutants into the atmosphere. Burning natural gas in the place of other fossil fuels emits fewer harmful pollutants, and an increased reliance on natural gas can potentially reduce the emission of many of these most harmful pollutants.

Global warming, or the 'greenhouse effect' is an environmental issue that deals with the potential for global climate change due to increased levels of atmospheric 'greenhouse gases'. An increase in these greenhouse gases will translate into increased

temperatures around the globe, which would result in many disastrous environmental effects. In fact, the Intergovernmental Panel on Climate Change (IPCC) predicts in its *'Fourth Assessment Report'* released in 2007 that during the 21st century, global average temperatures are expected to rise by between 2.0 and 11.5 degrees Fahrenheit. A *Fifth Assessment Report* is expected to be released by the IPCC between 2013 and 2015.

The principle greenhouse gases include water vapor, carbon dioxide, methane, nitrogen oxides, and some engineered chemicals such as cholorofluorocarbons. While most of these gases occur in the atmosphere naturally, their levels have been increasing due to the widespread burning of fossil fuels by growing human populations. The reduction of greenhouse gas emissions has become a primary focus of environmental programs around the world.

One of the principle greenhouse gases is carbon dioxide. Although carbon dioxide does not trap heat as effectively as other greenhouse gases (making it a less potent greenhouse gas), the sheer volume of carbon dioxide emissions into the atmosphere is very high, particularly from the burning of fossil fuels. In fact, according to the Energy Information Administration in its December 2009 report *'Emissions of Greenhouse Gases'* in the United States, 81.3 percent of greenhouse gas emissions in the United States in 2008 came from energy-related carbon dioxide.

Reducing carbon dioxide emissions can play a pivotal role in combating the greenhouse effect and global warming. The combustion of natural gas emits almost 30 percent less carbon dioxide than oil, and just under 45 percent less carbon dioxide than coal.

One issue that has arisen with respect to natural gas and the greenhouse effect is the fact that methane, the principle component of natural gas, is itself a potent greenhouse gas. Methane has an ability to trap heat almost 21 times more effectively than carbon

dioxide. According to the Energy Information Administration, although methane emissions account for only 1.1 percent of total U.S. greenhouse gas emissions, they account for 8.5 percent of the greenhouse gas emissions based on global warming potential. Sources of methane emissions in the U.S. include the waste management and operations industry, the agricultural industry, as well as leaks and emissions from the oil and gas industry itself. A major study performed by the Environmental Protection Agency (EPA) and the Gas Research Institute (GRI), now Gas Technology Institute, in 1997 sought to discover whether the reduction in carbon dioxide emissions from increased natural gas use would be offset by a possible increased level of methane emissions. The study concluded that the reduction in emissions from increased natural gas use strongly outweighs the detrimental effects of increased methane emissions. More recently in 2011, researchers at the Carnegie Mellon University released "Life cycle greenhouse gas emissions of Marcellus shale gas", a report comparing greenhouse gas emissions from the Marcellus Shale region with emissions from coal used for electricity generation. The authors found that wells in the Marcellus region emit 20 percent to 50 percent less greenhouse gases than coal used to produce electricity.

Thus the increased use of natural gas in the place of other, dirtier fossil fuels can serve to lessen the emission of greenhouse gases in the United States.

Smog and poor air quality

Smog and poor air quality is a pressing environmental problem, particularly for large metropolitan cities. Smog, the primary constituent of which is ground level ozone, is formed by a chemical reaction of carbon monoxide, nitrogen oxides, volatile organic compounds, and heat from sunlight. As well as creating that familiar smoggy haze commonly found surrounding large cities, particularly in the summer time, smog and ground level ozone can contribute to respiratory problems ranging from temporary

discomfort to long-lasting, permanent lung damage. Pollutants contributing to smog come from a variety of sources, including vehicle emissions, smokestack emissions, paints, and solvents. Because the reaction to create smog requires heat, smog problems are the worst in the summertime.

The use of natural gas does not contribute significantly to smog formation, as it emits low levels of nitrogen oxides, and virtually no particulate matter. For this reason, it can be used to help combat smog formation in those areas where ground level air quality is poor. The main sources of nitrogen oxides are electric utilities, motor vehicles, and industrial plants. Increased natural gas use in the electric generation sector, a shift to cleaner natural gas vehicles, or increased industrial natural gas use, could all serve to combat smog production, especially in urban centers where it is needed the most. Particularly in the summertime, when natural gas demand is lowest and smog problems are the greatest, industrial plants and electric generators could use natural gas to fuel their operations instead of other, more polluting fossil fuels. This would effectively reduce the emissions of smog causing chemicals, and result in clearer, healthier air around urban centers.

Industrial and Electric Generation Emissions

Natural gas is becoming an increasingly important fuel in the generation of electricity. As well as providing an efficient, competitively priced fuel for the generation of electricity, the increased use of natural gas allows for the improvement in the emissions profile of the electric generation industry. According to the National Environmental Trust (NET), now Pew Charitable Trusts (PEW), in their 2002 publication entitled 'Cleaning up Air Pollution from America's Power Plants', power plants in the U.S. account for 67 percent of sulfur dioxide emissions, 40 percent of carbon dioxide emissions, 25 percent of nitrogen oxide emissions, and 34 percent of mercury emissions. Coal fired power plants are the greatest contributors to these types

of emissions. In fact, according to World Watch Report 184, natural gas combined cycle power plants emit half as much carbon dioxide as modern super critical coal plants.

Natural gas-fired electric generation and natural gas-powered industrial applications offer a variety of environmental benefits and environmentally friendly uses, including:

- **Fewer Emissions** - Combustion of natural gas, used in the generation of electricity, industrial boilers, and other applications, emits lower levels of NOx, CO_2, and particulate emissions, and virtually no SO_2 and mercury emissions. Natural gas can be used in place of, or in addition to, other fossil fuels, including coal, oil, or petroleum coke, which emit significantly higher levels of these pollutants.
- **Cogeneration** - The production and use of both heat and electricity can increase the energy efficiency of electric generation systems and industrial boilers, which translates to the combustion of less fuel and the emission of fewer pollutants. Natural gas is the preferred choice for new cogeneration applications.
- **Reduced Sludge** – Coal-fired power plants and industrial boilers that use scrubbers to reduce SO_2 emissions levels generate thousands of tons of harmful sludge. Combustion of natural gas emits extremely low levels of SO_2, eliminating the need for scrubbers, and reducing the amounts of sludge associated with power plants and industrial processes.
- **Re-burning** - This process involves injecting natural gas into coal or oil fired boilers. The addition of natural gas to the fuel mix can result in NOx emission reductions of 50 to 70 percent, and SO_2 emission reductions of 20 to 25 percent.

- **Fuel Cells** - Natural gas fuel cell technologies are in development for the generation of electricity. Fuel cells are sophisticated devices that use hydrogen to generate electricity, much like a battery. No emissions are involved in the generation of electricity from fuel cells, and natural gas, being a hydrogen rich source of fuel, can be used. Although still under development, widespread use of fuel cells could in the future significantly reduce the emissions associated with the generation of electricity.
- **Combined Cycle Generation** – Combined-cycle generation units generate electricity and capture normally wasted heat energy, using it to generate more electricity. Like cogeneration applications, this increases energy efficiency, uses less fuel, and thus produces fewer emissions. Natural gas-fired combined-cycle generation units can be up to 60 percent energy efficient, whereas coal and oil generation units are typically only 30 to 35 percent efficient.

Essentially, electric generation and industrial applications that require energy, particularly for heating, use the combustion of fossil fuels for that energy. Because of its clean burning nature, the use of natural gas wherever possible, either in conjunction with other fossil fuels, or instead of them, can help to reduce the emission of harmful pollutants.

Pollution from the Transportation Sector - Natural Gas Vehicles

The transportation sector (particularly cars, trucks, and buses) is one of the greatest contributors to air pollution. Emissions from vehicles contribute to smog, low visibility, and various greenhouse gas emissions. About half of all air pollution and more than 80 percent of air pollution in cities are produced by cars and trucks. Currently, automobile manufacturers are under pressure to produce more environmentally friendly vehicles.

Natural gas can be used in the transportation sector to cut down on these high levels of pollution from gasoline and diesel powered cars, trucks, and buses. According to the Environmental Protection Agency, compared to traditional vehicles, vehicles operating on compressed natural gas have reductions in carbon monoxide emissions of 90 to 97 percent, and reductions in carbon dioxide emissions of 25 percent. Nitrogen oxide emissions can be reduced by 35 to 60 percent, and other non-methane hydrocarbon emissions could be reduced by as much as 50 to 75 percent. In addition, because of the relatively simple makeup of natural gas in comparison to traditional vehicle fuels, there are fewer toxic and carcinogenic emissions from natural gas vehicles, and virtually no particulate emissions. Thus the environmentally friendly attributes of natural gas may be used in the transportation sector to reduce air pollution.

Natural gas vehicles represent a growing segment of the transportation sector. According to the Natural Gas Vehicle Coalition, the use of natural gas for vehicles in the United States doubled between 2003 and 2009, with over 100,000 natural gas vehicles currently on US roads. A large portion of those vehicles are transit buses, which account for nearly 62 percent of all natural gas vehicles.

Natural gas is the cleanest of the fossil fuels, and thus its many applications can serve to decrease harmful pollution levels from all sectors, particularly when used together with or replacing other fossil fuels. The natural gas industry itself is also committed to ensuring that the process of producing natural gas is as environmentally-friendly as possible.

Implications on Marine Life

During drilling and extraction of gas deposits from the sea floor, releases of gas into the marine environment are inevitable. Gas is dumped into the sea mixed in with produced water, may leak from pipelines, tankers and underwater storage tanks, or

may be released during catastrophic well blowouts, explosions and smaller accidental spills. Spills and blowouts occur due to drilling equipment failure, corrosion of pipelines, human error, earthquakes, ice, storms, shipping accidents etc.

Pipeline failures are most commonly due to material or welding defects, but pipelines may also be hit by anchors or trawls, or affected by earthquakes or ground erosion. The environmental consequences of releases of natural gas into the sea are especially severe when they happen near shore, in shallow waters or in areas with slow water circulation.

Among the most dangerous situations are gas tanker accidents, which may trigger explosions when rapidly evaporating gas at the sea surface stimulates formation of gas clouds, which then can combust and explode, destroying every living thing in areas of up to 400 square km.

Many people think that natural gas would just bubble up to the surface and quickly evaporate off but in fact a significant portion dissolves in the water and is highly toxic to marine life. The gas can rapidly penetrate the bodies of fish, doing direct damage to gills, skin, chemoreceptors and eyes, and filling up the gas bladder, making the fish unable to control its buoyancy.

At concentrations of 0.02 - 0.05 mg/l, gas will be sensed by fish and they will move away from the premises. If however, fish are exposed to concentrations above 1 mg/l they become excited within seconds of contact, then disoriented and unable to flee. Within 15 - 20 minutes fish exposed to such concentrations show signs of acute poisoning, and they die within one or two days of exposure. Shellfish are also killed by exposure to gas. Zooplankton and phytoplankton can tolerate higher concentrations of gas than fish or shellfish can, as they perish at 2 - 5 mg/l.

Accidental gas releases on a migratory route of fish such as salmon, either in the sea or from a pipeline close to a river, can block a spawning migration. A localized release can thus have a regional impact.

Some fish, such as flounders, are more sensitive to gas than other species. Juveniles are more sensitive than older fish. Fish also become more sensitive if repeatedly exposed to low concentrations of gas. Fish are more vulnerable when water temperatures are high or when oxygen concentrations are low (as in a eutrophic estuary in summer). Under conditions of cold temperature and high pressure, gas may react with water to form hydrates. These can be trapped and accumulate under ice in winter and be converted to methane as water temperature rises in spring, with serious environmental consequences. If the gas is "sour," or contains sulfides, it is much more highly toxic to marine life.

Preparations to Mitigate Risks

While the dependency on ocean resources is growing, the demand that their use is done in a careful and environmentally responsible manner – based on the experience of other nations worldwide – is perceived as a nuisance.

In order to keep this blessing from turning into a curse, it is time for the government to step up to the plate. A massive oil leak in Israel will have serious ramifications that are likely to extend beyond ecological damage. Such an event will cripple power and desalination facilities along the coast, damage harbor activities, close down beaches, paralyze the fishing industry and damage tourism.

The Ministry of Environmental Protection is constantly warning that Israel is not equipped to deal with a potentially massive pollution that could be the result of an offshore drilling malfunction as the state continues to issue drilling permits without conditioning them with disaster contingencies.

A massive maritime pollution as a result of a malfunction in one of the rigs is not a far-fetched scenario, as the Gulf of Mexico disaster proved just three years ago. But the concerns go beyond a leak. The simultaneous exploration for gas and oil is a complex technological process that has an innate potential of harming the maritime ecosystem. The main environmental concern is from the waste produced by the drilling process, as well as by the physical presence of the rigs, which can affect biologically sensitive maritime habitats. The planned drilling sites contain a large number of species of wildlife. Many of them would have a hard time recovering from damage to their habitats due to small populations.

Israel presents a unique environment with a variety of geological formations, aquifers and diverse species. Given these conditions, the regulations aim to make sure that work in this industry "will be carried out in the safest mode possible," and oil and gas developers must abide by them.

Israel is facing an enormous challenge because alongside the opportunities presented by the ocean, there are many risks as well. In order to prevent them in advance the state must adopt the norms practiced worldwide, including allocation of funds, promoting legislation and increasing transparency.

Such environmental guidelines were published in February 2012 in collaboration with the Ministry of Environmental Protection. After which, the drafted documents were open to public comment. While the set of guidelines issued for onshore drilling were prepared under the Petroleum Law and its regulations, the Ministry of Energy and Water has now made available updated environmental information for offshore drilling. Israeli environmental regulations do not legally apply to offshore drilling sites in the country's Exclusive Economic Zone, where many of the country's typical laws do not apply.

Concluding remarks

Natural gas has a potential in tackling many existing environmental problems related or caused by energy sources, from electricity generation to industry to transportation. It is necessary to remember that such solutions may require large preliminary investment in infrastructure and a long term, continuous gas supply to the Israeli economy that might be at odds with the export plans of the gas producers.

"Knowledge had not yet been accumulated or been sufficiently communicated to decision makers, so much so that there is a fear that policy makers and professionals at the government level are making decisions based on weak scientific ground and taking risk presumably with irreversible negative environmental consequences and that may hold back development of potential energy or resources."
Dr. Sinaia Netanyahu

The entire gas exploitation process itself, including exploration, development and production is prone to having a substantial negative ecological impact on its surroundings, with some of its implications not fully understood yet. Although means to minimize these effects were and are being developed, it remains a significant ramification of gas production. While clearly well-intended, the Ministry of Environmental Protection appears to be unprepared for many possible occurrences, such as offshore drilling malfunctions, and efforts should be made towards the improvement of the current situation, including collaborating with the European community and amongst the region on the matter.

The Regional Lens

Does Natural Gas Create an Incentive for Cooperation among Eastern Mediterranean Countries?

The eastern Mediterranean region—defined in this report as Cyprus, Israel, Jordan, Lebanon, Syria, and the Palestinian Territories—is currently undergoing changes to its energy landscape. With expected economic growth, and the population of the region forecast to grow from 45.3 million in 2010 to between 58 and 62 million in 2030, energy demand should increase noticeably over the next two decades. At present levels of consumption, regional oil and natural gas reserves are unlikely to last for more than a few decades. Fortunately, recent discoveries of large hydrocarbon resources—particularly natural gas—in the offshore Levantine Basin significantly alter the supply-side forecasts for the region. These discoveries have the potential to provide the necessary energy supply to meet growing regional demand and possibly even spur exports.

"If the Lebanese have gas, if we have gas and if the Palestinians have gas in front of Gaza (which they do), is it intelligent, wise or worthwhile for it to be three pipes? …I believe there's an option for the joint use of energy infrastructure. …There does not have to be a direct discussion. Even a medium-size foreign company can come and say – 'Kids, you can fight as much as you like, but your gas will flow in a single pipe built by us'."
Dr. Oded Eran

There are several issues facing the region that could significantly affect how quickly and how successfully such changes occur. Among the major issues in the region, physical and economic security as well as offshore hydrocarbon development will have the most influence on the region's energy sector. Unrest in Syria and Egypt and territorial disputes between several of the countries in the eastern Mediterranean will

impact regional energy production, consumption, and trade. Furthermore, negative economic developments in the region—influenced by issues such as the Cyprus debt crisis and the civil war in Syria—could undermine demand, interrupt production and trade, and threaten the viability of several energy infrastructure projects. Overcoming these challenges is critical to the success of the region's energy future.

The conflict in Syria limits the ability and desire of companies to operate in that country, as most of the international oil companies abandoned their operations in the country as the violence escalated over the past few years and as sanctions targeting Syria's energy sector came into effect. Recently Israel also moved ahead with exploration in the disputed Golan Heights region—which both Israel and Syria claim—awarding a drilling contract in February 2012. Exploration for hydrocarbons is proceeding slowly in Jordan, but several major international energy companies have interests in the country. Based on the results of exploration to date, areas near Jordan's eastern border with Iraq and around the Dead Sea could contain additional resources, but there have not been any major discoveries announced.

There is limited onshore exploration in Cyprus, Lebanon, and the Palestinian Territories. In total, with the current security environment in Syria and the limited efforts in other countries in the eastern Mediterranean, most of the exploration in the near term will be focused on the offshore areas of the Mediterranean Sea. Table 2 summarizes oil and natural gas consumption in the region.

Although there is no formal contact between Israel and Lebanon or between Israel and the Hamas, which controls Gaza, the suggested type of cooperation does not necessarily require it. Even a medium-sized energy firm can potentially allow the three countries to maneuver the gas through a pipe built by them. Unionization of gas production and exploitation, however, would require direct contact, if not a binding cease fire agreement.

Country	Proved reserves, 2013 (billion barrels)	Total oil supply, 2012 (thousand barrels per day)	Total petroleum consumption, 2012 (thousand barrels per day)	Proved reserves, 2013 (trillion cubic feet)	Dry production, 2011 (billion cubic feet)	Consumption, 2011 (billion cubic feet)
Cyprus	--	0.01	60.04	--	--	--
Israel	0.01	5.84	301.65	9.48	91.82	117.25
Jordan	(s)	0.16	108.61	0.21	8.12	37.43
Lebanon	--	--	104.86	--	--	--
Palestinian Territories	--	--	23.26	--	--	--
Syria	2.50	182.46	257.65	8.50	277.93	286.76
Total, Region	*2.51*	*188.47*	*856.07*	*18.20*	*377.87*	*441.44*

Total oil supply includes crude oil, condensates, natural gas plant liquids, refinery processing gain, and other liquids

(s) = Value is too small for the number of decimal places

"--" = No value

Source: U.S. Energy Information Administration

Table 2: Oil and natural gas reserves, production, and consumption

In that same spirit, Noble Energy sees gas exportation as an opportunity to strengthen economic ties between Israel and its neighbors. A partnership with Cyprus is already being negotiated. Further cooperation can be attained, for example, by selling gas to Jordan, a country which, like Israel, was cut off from its essential supply of gas when the pipeline in Egypt has ceased to function following an attack. Other possible opportunities are made available by selling gas to Egypt, which despite having vast offshore reserves suffers from gas shortages due to misguided policies; and selling gas to Turkey, which has a vast and growing market.

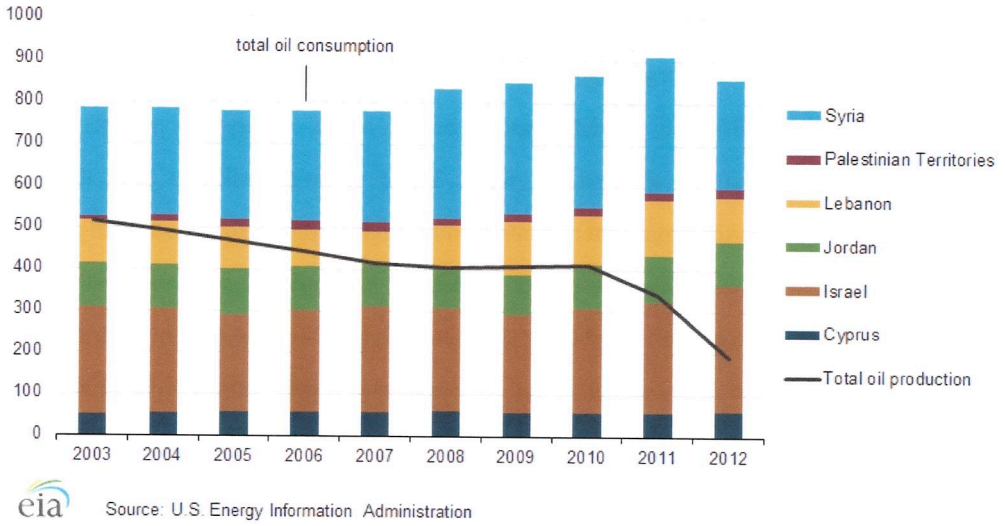


Figure 9: Eastern Mediterranean oil production and consumption, 2003-2012, thousand barrels per day

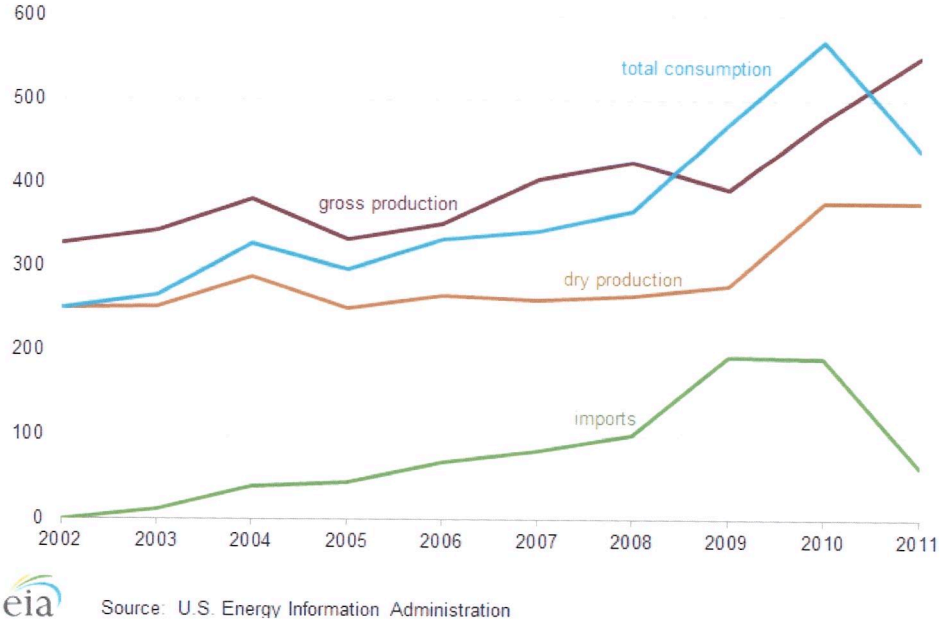


Figure 10: Eastern Mediterranean regional natural gas flows, billion cubic feet

To meet expected rising demand, countries in the region will need to either produce or import additional energy supplies. Israel's successful development of offshore natural gas fields significantly altered its energy profile, as the country now projects to meet internal natural gas demand for years. Those volumes will also help it reduce petroleum consumption. Other countries in the region hope to follow suit, but progress has been uneven. If they are unable to produce oil or natural gas domestically, those countries will need to import energy supplies from outside the region. With unrest in nearby suppliers like Iraq and Egypt, procuring such supplies may prove difficult.

Joint projects

Like Israel, Cyprus hopes that its recent discoveries will allow for substitution of petroleum products towards utilizing more natural gas in the industrial, commercial, and residential sectors. At present, Cyprus neither produces nor consumes any natural gas, nor is the country an oil producer. However, Cyprus plans to begin natural gas production from the offshore Aphrodite field as early as 2017. The Energy Information Administration estimates petroleum products met up to 98 percent of Cyprus' total primary energy demand in 2011, so the effect of oil prices on the country's economy is significant. Consumption of petroleum averaged 55,000 barrels per day between 2000 and 2011, peaking in 2008 at 60,000 barrels per day (figure 9).

The newfound capital and its abundance in different territorial waters open the door for joint gas projects that can financially benefit the entire region. One of them is already on the path towards establishment, with Cyprus. Cyprus Hydrocarbons' approach is to proceed urgently with all the aspects of developing Cyprus's natural gas and the LNG plant at Vasilikos, and to pursue the case of the Eastern Mediterranean gas corridor more vigorously. There is a great willingness for cooperation with Israel, but this policy is independent from Israeli or Lebanese gas, and the project is commercially viable to proceed without such cooperation.

There are several other possibilities for joint gas projects. All of them are supported strongly by Delek. The first is collaboration with Jordan, which is in great need of gas and requires a relatively short pipe - 10 km long. Another suggested cooperation is with Turkey, one that could work as a bridge to make amends between Turkey and Israel. Supplying gas to a country that borders Europe may help connect Israel to the European grid in the long term. Supplying gas to Egypt will benefit from the fact that there already is an infrastructure connecting the country to Israel.

The view from Washington

As investors and entrepreneurs are seeing commercial opportunities in the Eastern Mediterranean gas, diplomats and politicians in Washington see in it diplomatic opportunities. Among those are the Israel-Turkey rapprochement, the demarcation of a maritime boarder between Lebanon and Israel and the so called "Cyprus problem". The American Secretary of State, John Kerry, is very interested in going forward with the peace process, and the utilization of the Palestinian gas can give that process an economic boost, creating an alliance based on joint goals.

"There's a core of people in Washington with their eyes fixed on the Eastern Mediterranean, they are concerned because an American company has taken the lead in the exploration of this zone; they are concerned because of possible security risks; they are concerned because of the presence of US Navy in various parts of the Mediterranean, which could conceivably become involved if ever there were to be any clashes at sea in the region."
Sir Michael Leigh

On the other hand, there is concern among a small group of Israeli policy makers that enlarged gas revenues and the chosen financial mechanism will affect the US's willingness to aid Israel, as it is. These apprehensions do not seem to be based on any clear message from US officials, nor do they gain traction in the media coverage.

Delimitation and lessons from international experience

The propositions for joint projects of countries currently embroiled may sound unlikely, but cooperation over the utilization of energy sources between rival nations in not unheard of. For example, the fact that both Russia and Norway are major gas and oil exporters, often in competition with one another, has not prevented them forming a joint project – the Shtokman field, found on a shelf in the Barents Sea – for the benefit of both[5].

A major issue that had to be dealt with in the case of the Shtokman field was its delimitation. Delimitation is the process of drawing boundaries, specifically between and inside gas and oil reservoirs. It is an inevitable step in the process of gas and oil exploration and production, and can become a cause for international disputes. Beyond the economic value of the reservoirs divided, naval boundaries often have strategic and political meanings.

An example for cooperation despite a border dispute is the Caspian Shelf. Originally, a treaty between Iran and the Soviet Union has labeled the Caspian Sea as a lake, a definition that is meaningful regarding borders and the permission of foreign vessels.

Negotiations regarding the demarcation of the Caspian Sea have been going since the 90's, with each country obviously aspiring to assure itself a considerable share. In 2003, Russia has signed treaties with Azerbaijan and Kazakhstan that divided the northern part between them, but they are not recognized by the two other countries bordering the sea, Iran and Turkmenistan.

However, even whilst a dispute over the borders, Kazakhstan and Russia signed an agreement in 1995, regarding construction of an oil pipeline with the capacity of 67 million metric tons on the route of Tengiz-Tikhoretsk-Novorossiysk (CPC pipeline)

[5] It should be noted that this project was eventually postponed due to the gas production being too expensive.

with Oman and a consortium of foreign oil companies. As per the agreement, Russia's share was 24%, Kazakhstan had 19% and Oman 7%, the rest was distributed among eight oil companies. In 2008, CPC transported 31.5 million tons of crude, down from 32.6 million tons in 2007. In the first three months of 2009, the pipeline transported 8.7 million tons of oil.

The fact that rival or competing countries, even without establishing agreed borders managed to cooperate in order to gain mutual benefits inspires some hope when dealing with future cooperation in the Eastern Mediterranean region.

Focus on Turkey

Legal positions

Although Cyprus is a European Union member state recognized by the international community, Turkey does not acknowledge the country's existence and has held a military occupation of the northeastern portion of the island since 1983.

Known commonly as "North Cyprus," this section of the island is recognized only by Turkey as the Turkish Republic of Northern Cyprus. Greek Cypriots, on the other hand, would like to see a unification of the entire island under the Cypriot government.

The increasingly significant natural gas discoveries along Cyprus's shores have thereby added fuel to a long-burning fire, as Turkey claims that a share of these resources belong to North Cyprus. Turkey objects to Cypriot exploration on its western shores as it deems a portion of these areas to be in its own continental shelf and another section to belong to Egypt (marked in red in figure 11). Any Turkish opposition over Cypriot exploration in its eastern waters comes only from the idea that Turkey objects Cyprus's sovereign right as a country to claim these resources. The explorations deemed by Turkey as Cypriot trespassing is marked in green in figure 11.

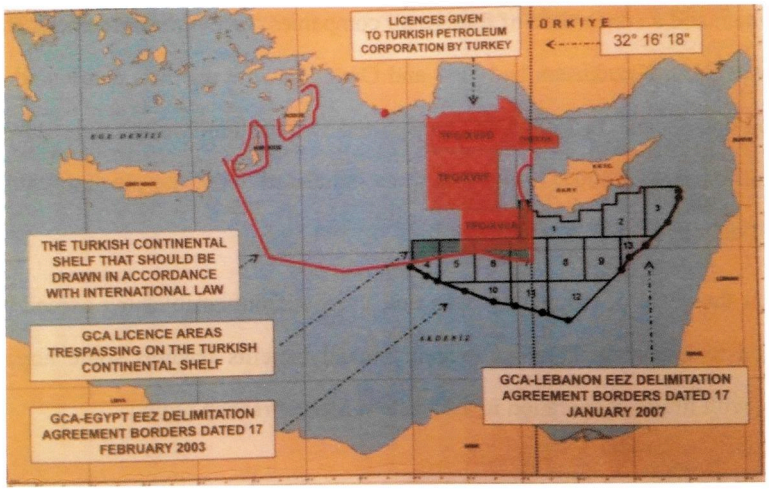


Figure 11: Turkish and Cypriot gas claims

Furthermore, Turkey is pressuring Egypt to rethink their existing agreement with Cyprus regarding the gas fields and their delimitation. This agreement can be viewed in figure 12, where the red line defines the Turkish thesis, while the green line shows the existing agreement between Cyprus and Egypt. The 12,000 square-kilometers of potential Exclusive Economic Zone, as Turkey contests, are essentially a loss of Egypt to Cyprus. Turkey claims that had the line been drawn according to Turkish suggestion, then those additional 12,000 square-kilometers would have belonged to Egypt.

The blue line drawn in figure 12 envisions what would have happened if the same principle had been applied to the question of the alignment of Exclusive Economic Zones between Egypt and Greece. Egypt would have lost another 7,400 square-kilometers if that had been done.

Turkey has been lobbying vigorously in Egypt, especially after the recent regime changes. Even if the suggested changes aren't made, Egypt may still use this as leverage to renegotiate with Cyprus some of the previously agreed concession blocks, and its entitlement to them.

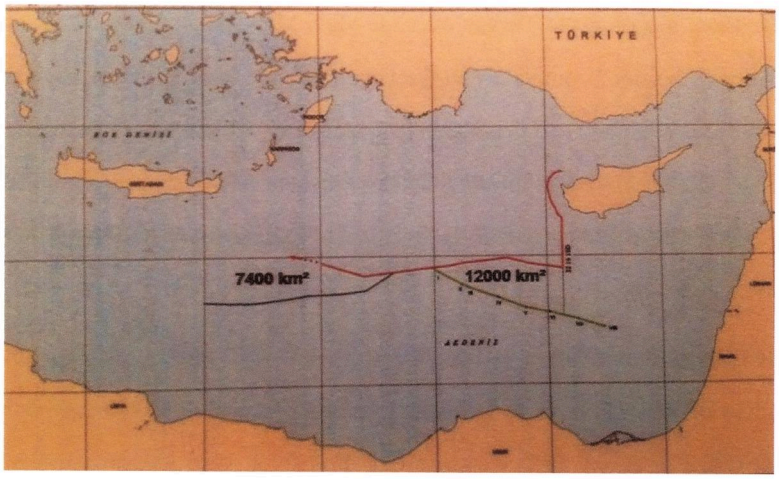


Figure 12: Eastern Mediterranean regional natural gas flows, billion cubic feet

The Turkish Republic of Northern Cyprus's position regarding the gas is either that the Republic of Cyprus should stop drilling activities and research, or that a special commission could be established in which the Turkish and Greek parts of the island can negotiate a revenue sharing model regardless of the chosen course of action.

Israel could be instrumental in easing this strain – both over hydrocarbon allocations and perhaps toward a "final settlement" between the two entities – if the country would step in as a quiet middleman to help negotiate a profit-sharing agreement.

While ending the political conflict between Cyprus and Turkey would be optimal, an agreement on natural gas could occur without requiring Turkey to recognize Cyprus as a state or requiring Cyprus to recognize the Turkish portion of the island as independent.

Strategic decisions

The relationship between Turkey and Israel had always had a strategic importance to both sides. Joint gas exploration and production efforts can serve as means to build a bridge to it once again. However, Turkey has another aspect to consider when assessing these issues, since a part of the area developed by Cyprus is claimed by

Turkey. Israel's apology to Turkey over the Mavi Marmara flotilla incident may not have "turned the tide" completely in the countries' relationship, but it has reminded Turkish officials that the two neighbors have many mutual interests in the current time period. A relationship based on the joint development of energy production between the two countries would be even more sustainable than a relationship based on mutual security interests.

It should be noted that Turkey is heavily gas dependent; its energy hydrocarbon bill is topping 50 billion USD a year, accounting for approximately 50%-60% of its current account deficit. 51% of Turkey's electricity production is dependent on natural gas and half of the gas imports originate from a singular primary source – Russia. Turkey is therefore in great need of new gas projects.

Such new project is the Trans-Anatolian Pipeline (TANAP), a proposed natural gas pipeline from Azerbaijan through Turkey to Europe. If constructed, it would transport gas from the second stage of the Shah Deniz gas field, the largest natural gas field in Azerbaijan situated in the South Caspian Sea. It is currently the focal point for Turkey's future gas consumption. The pipeline is expected to cost $7 billion, with construction planned to start in 2014 and to be completed by 2018. The intended capacity of the pipeline would be 16 BCM of natural gas per year at the initial stage and would later be increased up to 60 BCM at the final stage (in 2030).

While Turkish companies BOTAS and TPAO had a total of 20% of the shares in TANAP, 29% of the shares that the Azerbaijani oil company SOCAR had in that project were sold over to a consortium of companies, including Total of France, which is also pursuing entitlement rights in concession blocks that Cyprus has declared. This makes the relationship between Total and Turkey much more complicated.

It remains to be seen if Turkey can enforce its position on companies seeking to exploit its natural resources, by perhaps embargoing them and banning them from

participating in drilling activities within concession blocks clouded in disagreement. The odds of Turkey risking a territorial dispute, however, remain slim, as Cyprus is a member of the EU and the concession blocks are in EU territory. Furthermore, the agreement between Egypt and Cyprus has been deposited in the United Nations, giving it international legitimacy.

At the moment, however, Turkey does not have any objections regarding the exploration and use of Israeli gas. Israeli gas export is perceived as a Turkish opportunity and even if it is being exported through the Greek side of Cyprus, it would probably not deter Turkish cooperation.

Impact on the EU – Interests and Future Energy Needs

The next decade is going to see many changes regarding European gas production and demand. The need to define the future of European gas supply and demand in the face of challenging market developments has caused government officials, gas producers, pipeline companies, transmission system operators, regulators, industry analysts, public-opinion leaders and solution providers to gather each year in order to formulate a policy together in the European Gas Conference.

Presentations at the gas conference in February 2013 in Vienna identified that the additional gas demand in the EU may reach 60 BCM per year by 2020 and up to 100 BCM by 2025. The EU is looking for secure and independent sources for its future gas needs. The demand for gas is so great that Israeli and Cypriot projects do not compete over supply, they complement it.

Although indigenous production in Europe is increasing very rapidly (figure 13), there is a decrease in the amount of available gas. Even under the assumption of almost zero growth in gas demand, the extra amount required to compensate for the depletion of gas resources is assessed at 100 BCM by 2025, and is projected to hit 150 BCM by 2030.

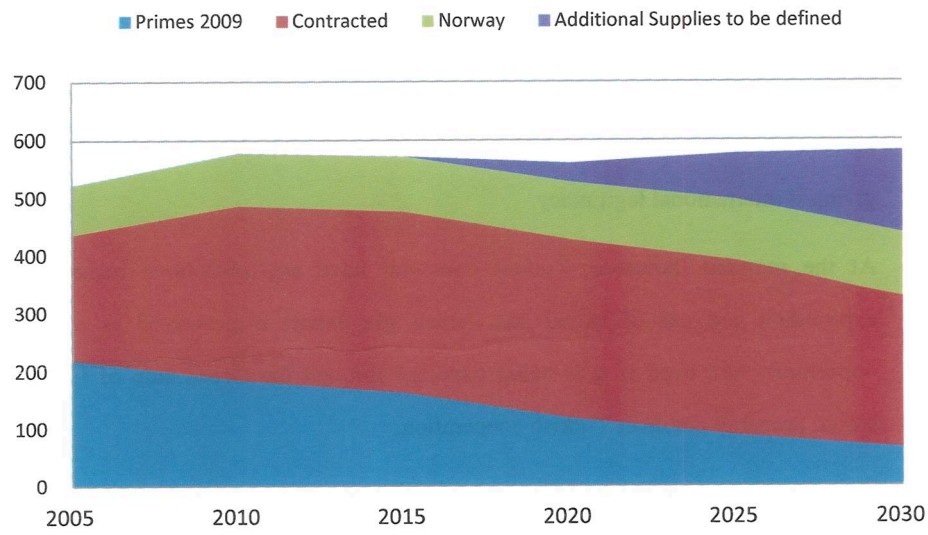


Figure 13: Eorugas 2010 baseline case

At the same time, EU dependency on outside will increase from approximately 60% today to about 75% in 2020 and over 80% in 2030. EU's dependence on just a few sources, many of them external to the union, is growing. The main source is Russia, representing 35% of total EU gas imports, and other important sources include Norway, with 27%, Algeria with 14% and Qatar with 8%. Libya and Egypt have a share of 2% to 3%, each.

A meeting of the European Council on these matters has resulted in a decision for national and EU measures to be taken to boost energy infrastructure. This will promote the development of Europe's technological and industrial basis. Another decision was to intensify the diversification of Europe's energy supply and develop indigenous energy recourses to ensure security of supply, reduce EU's external energy dependency and stimulate economic growth.

The commission also intends to promote development of on-shore and off-shore indigenous sources of energy with a view to their safe, sustainable and cost-effective exploitation while respecting Member State choices of energy mix.

Hence, the EU will probably pursue its efforts to deepen its energy dialog with Israel, with Egypt, Lebanon and Turkey, in order to create the conditions for mutual benefits. What the EU can offer is international partnership, support on investments, specialized technology and expertise. Energy collaborations also bring to businesses greater investment certainty, access to markets and technology partnerships.

On the other hand, forecasting the future demand depends on many factors, such as the volume of demands from Europe, whether the demands are short or long term, and interfuel competition. Competition in general is intense in this market since the North American market is closed for exports; therefore all other exporters are targeting the European and Asian markets.

Delivery Options and Possible Corridors - Strategic and Economic Concerns

The decision by Cyprus's Ministerial Council in 2012 to establish an LNG plant at Vasilikos, reconfirmed by its president in April 2013, was vital as it makes it possible for Cyprus, as well as neighboring countries, to access world markets not just in Europe but also the Far East, thus contributing to the security of sales and stability of prices in the longer term.

With the timely establishment of the LNG plant, Israel and Lebanon should also be able to bring their gas to Cyprus for liquefaction, making it possible to create a world class LNG hub at Vasilikos (and potentially other gas or energy dependent industries).

This is one of the main reasons KOGAS, the largest LNG trader in the world, decided to invest in Cyprus. Similar reasons apply to ENI and Total. Both have their own means for transport, regasification and distribution of LNG in Europe, as well as being experienced marketers of LNG.

Figure 14 shows a possible layout for this plant – an onshore facility to liquefy gas for export. Technip is currently performing "Select Phase" development, including concept selection studies, collection of site specific data for FEED (Front-End Engineering Design), permitting and construction execution plans, technical and commercial FEED request for proposal bid package, project schedules and cost estimate.



Figure 14: Possible Layout of Cyprus LNG Plant in Vasilikos

By 2025 the Eastern Mediterranean market could be in a position to export 25 million tons LNG (35 BCM) per year, starting with 5 million tons (7 BCM) by 2020. This could rise to 35 million tons (50 BCM) per year if Vasilikos becomes an LNG hub for the region. As a result, by 2025 the Eastern Mediterranean could supply 50% of the additional gas needs of the EU. Even if due to market forces only half of this amount is exported there, it still makes the Eastern Mediterranean a key gas supply route to

Europe. Through the Eastern Mediterranean gas corridor it could form a new independent and secure supply of LNG which could contribute substantially to the EU's future energy security.

As was stated before, presentations at the European Gas Conference 2013 identified that additional gas needs of the EU may reach 60 BCM per year by 2020 and up to 100 BCM by 2025 (figure 13). Many references were made to Russia, Norway, the Caspian, Qatar and even Australia and shale gas from Poland as potential sources of this additional gas. Still, there was no reference to the Levantine Basin and the Eastern Mediterranean gas corridor. Lobbying and promotional work has to be made in order to stimulate interest in the region.

Without Cyprus's president's intervention for the Eastern Mediterranean corridor, the only gas corridor that was on the European Council's agenda was the Southern Corridor, which involves gas supply to Europe through pipelines passing through Turkey (such as TANAP).

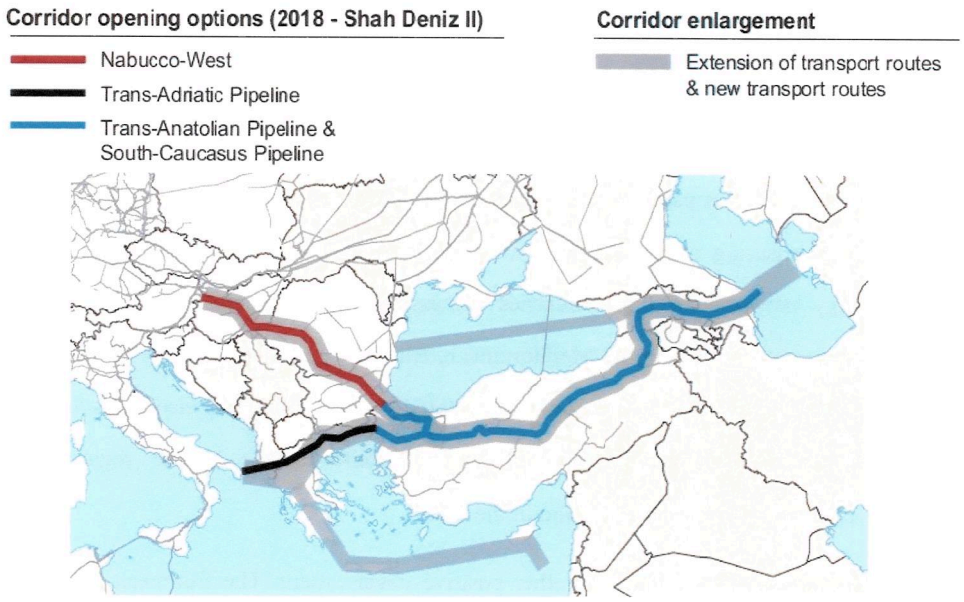


Figure 15: Corridor opening options

Cyprus proposed three projects of common interest to the EU: an Israel – Cyprus – Greece - Europe gas pipeline, LNG storage tanks at Vasilikos and an Israel – Cyprus - Greece electricity cable interconnector.

By including the Israel-Cyprus-Greece-Europe gas pipeline, it is the first time the EU recognizes the Eastern Mediterranean region as a gas export route to Europe, which does not rely on going through Turkey but goes directly to Europe through Greece.

President Anastasiades made a clear statement regarding the Eastern Mediterranean Corridor as a separate gas supply corridor to the EU in the form of LNG from the LNG hub at Vasilikos. However, there is a lot of work to be done to be officially recognized by the EU, but at least there is some form of reference to the Eastern Mediterranean Corridor.

The recent EU Council conclusions referred to swift implementation of the trans-European network for energy (TEN-E) and the adoption of projects of common interest, stemming from wishing to support efforts across the EU to achieve effective interconnection between member states.

The interconnection, interoperability and development of trans-European networks for transporting electricity and gas are essential for the effective operation of the internal energy market in particular and the internal market in general. TEN-E play a crucial role in ensuring the security and diversification of supply. Interoperability with the energy networks of third countries (accession and candidate countries and other countries in Europe, in the Mediterranean, Black Sea and Caspian Sea basins, and in the Middle East and Gulf regions) is essential. Access to TEN-E also helps to reduce the isolation of the less-favored, island, landlocked or remote regions, thus strengthening territorial cohesion in the EU.

Since then there had been another positive development. The European Investment Bank (EIB) President has said on May 2013 that the bank is interested in supporting

the Cyprus LNG project, at least in terms of providing financial and technical advice and possibly EU funds. The EIB is the only bank owned by and representing the interests of the EU member states and aims to implement EU policy. A statement of support from the EIB indicates growing interest in the Eastern Mediterranean.

Cyprus National Hydrocarbon's Company plans to proceed urgently with all aspects of developing Cyprus's natural gas, starting with the infrastructure required for the LNG plant at Vasilikos. Both Israel and Cyprus must make the case for the Eastern Mediterranean gas corridor at all levels emphasizing its potentially substantial contribution to EU's future gas needs and security. Various commercial partners, including Noble, Total and ENI/KOGAS, support this approach.

For Cyprus the key milestones are the start of construction as early in 2016 as possible, thus creating thousands of much needed employment opportunities during its economic crisis. The delivery of natural gas to the island by early 2019 will lead to major reductions, possibly 50%, in the cost of fuel for electricity and finally, the export of LNG by early 2020 producing much needed revenue and profits.

If Cyprus pursues the development of its natural gas resources correctly, then by 2025 Vasilikos can become the LNG hub for the region – including Israel and Lebanon. The Eastern Mediterranean gas corridor will be of major strategic importance to Europe, firmly establishing the Levantine Basin and Cyprus within the energy and political map of the EU. Vasilikos has the potential to become a major center of gas-based and energy-intensive industries, with major long term employment opportunities.

Currently, there are two main delivery options for gas export from Israel's most recent discovery, Leviathan: either transporting gas through a pipeline, or to liquefy it. Pipeline transport is considered cheaper and faster by Delek Drilling. The main

options for pipelines are the already existing pipe to Egypt and a suggested line to Europe, passing through Turkey or Greece through Cyprus (figure 16).

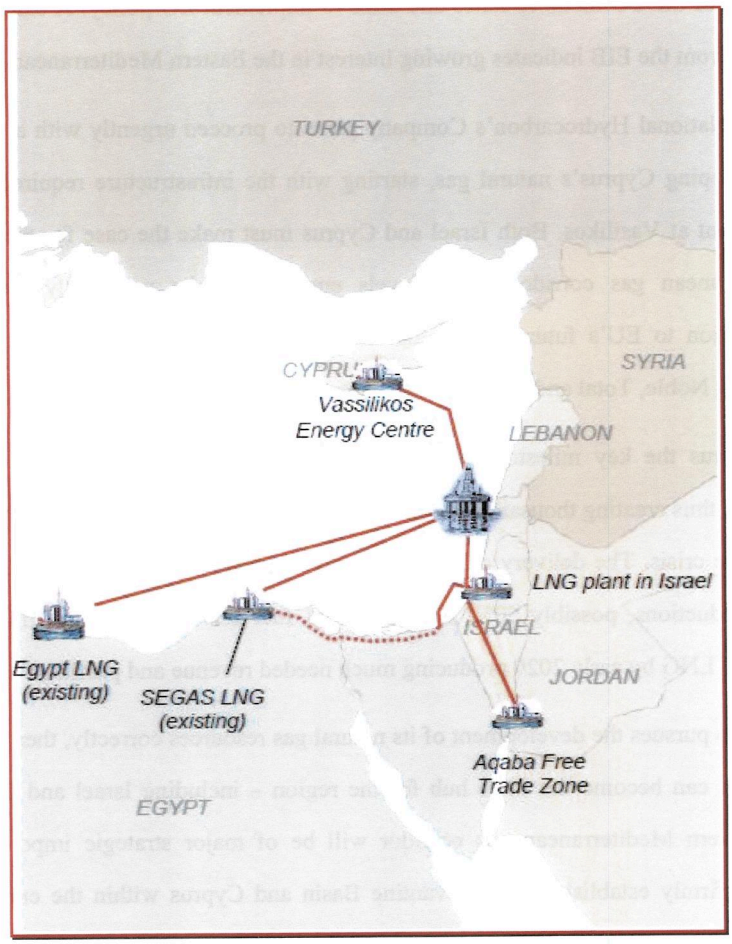


Figure 16: Existing and future pipelines and LNG centers

Two closer promising targets for export via a pipeline are Turkey and Jordan. The Turkish NG annual 2012 demand is about 48 BCM and growing rapidly. Despite Turkish plans on being an energy hub for Europe, most of the natural gas in Turkey is imported. In 2012, 39.2 BCM, which constituted 83% of Turkey's natural gas, were imported by pipeline, and 6.8 BCM, which accounted for 15%, were imported by LNG (figures 17 and 18 show the origin countries). Turkey has five pipelines and two

LNG terminals. As mentioned above, a pipeline to Turkey can be connected to the European grid, thus allowing export to both.

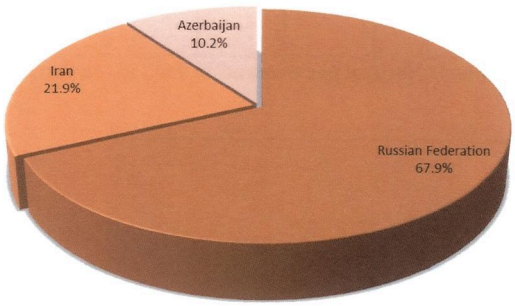


Figure 17: Pipeline Import to Turkey, 2012

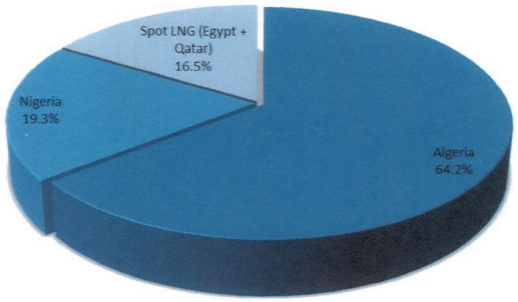


Figure 18: LNG Import to Turkey, 2012

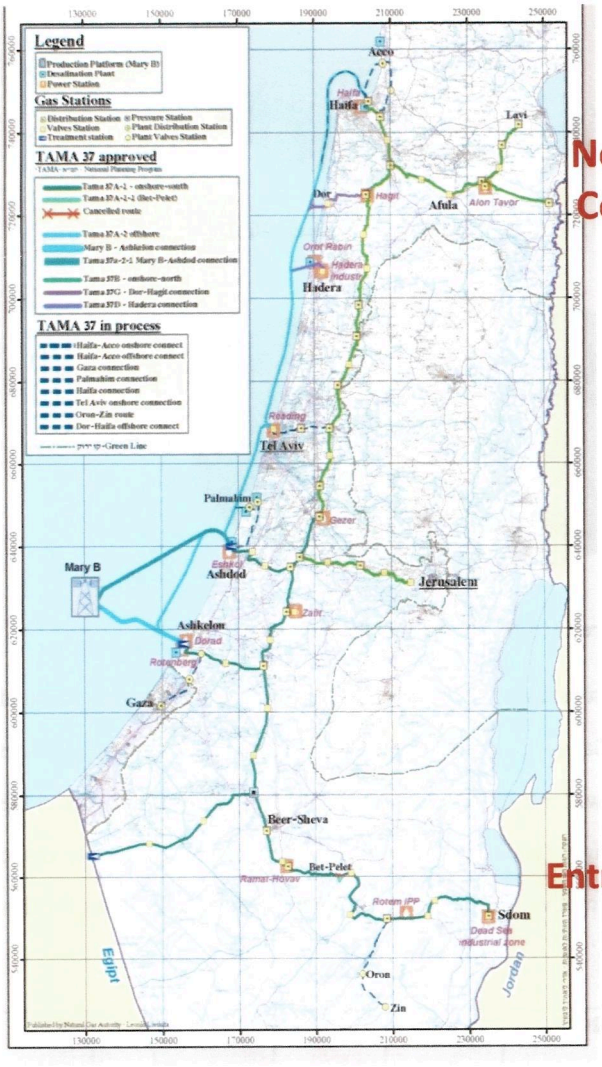
In Jordan, natural gas is a substantial primary energy source (table 3) with demand reaching 3 BCM per year. Gas is the source of 80% of electricity production (68% in 2010). Electrical energy growth rate stands on 7.7% until 2015, 6.7% onwards and the demand would rise accordingly (table 4). The growing demand and proximity make delivery to Jordan highly attractive. There are two possible entry connections for this line, as seen in figure 19.

Year	**2008**	**2009**	**2010**	**2011**	**...**	**2015**
Primary Energy Source	36.8%	39.9%	31.1%	11.7%	...	**29.5%**

Table 3: Natural gas as the primary energy source in Jordan

Year	2007	2008	2009	2010	2011	…	2015
Natural Gas Demand, BCM	2.64	2.94	3.37	2.52	0.83	…	5+

Table 4: Natural gas demand in Jordan – a forecast



North Entry Connection

Dead Sea Entry Connection

Figure 19: Possible entries

Israel and Cyprus's natural gas fields are well situated between high priced liquefied natural gas (LNG) markets in Asia and Europe, where demand is expected to rise (figures 20 and 21). Their natural gas composition is excellent, requiring only limited processing while benign weather conditions are favorable. The Israeli law currently permits export of hydrocarbons. There are potential sites for an LNG facility identified in Israel (MED/ RED), Cyprus, Jordan and Egypt. The relevant partners are presently evaluating the different locations.

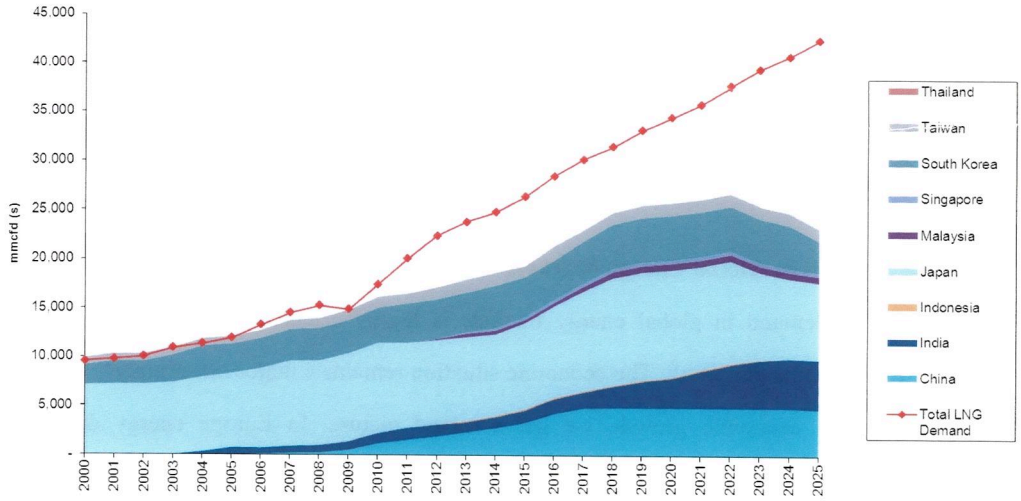


Figure 20: LNG Projected Demand Curves – Asia

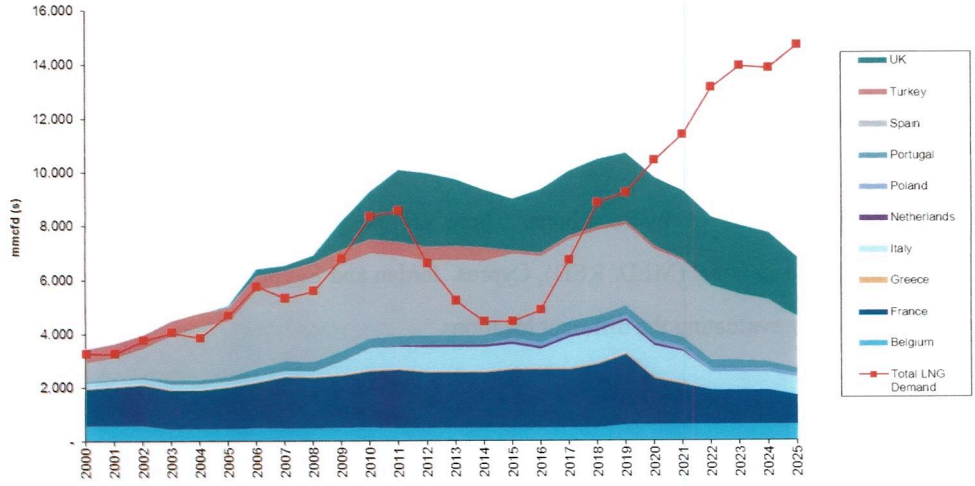


Figure 21: LNG Projected Demand Curves - Europe

Trends in Global Energy Markets

The demand in global energy markets is highly affected by the global economic situation and growth. The economic situation remains a major uncertainty - looking at global economic growth, we get a mixed picture. In Europe energy demand is deteriorating due to low economic growth and sovereign debts. The United States and the North American market, while more economically stable and considered the most attractive regional market, are approaching energetic independence due to the shale gas revolution and may become a possible gas exporter (after 2025). China's economy is slowing, but apparent large-scale shale gas deposits may affect the demand for imported gas. This demand may be met by China's own resources.

Future energy demand is hard to predict, especially in the long-term period. Existing trends in global energy are complex: on one hand, there is a decline in the energy consumption of developed economies due to slowdowns in economic growth, while growing regional energy independence and greater efficiency of alternative fuels further reduces demand. On the other hand, the post-Fukushima effect on nuclear

energy generation and the transformation into gas-based power generation increases it. Another aspect is the development of deep-water, arctic and other unconventional oil and gas resources, which also bring ecological and climate change concerns.

Security of demand is just as important to producers as security of supply is to consumers, and so it is important to have a better understanding of demand-side developments.

Concluding remarks

In conclusion, the recent gas discoveries in the eastern Mediterranean provide great opportunities to the countries in the area, Israel notwithstanding. These would be best utilized through inter-state cooperation. A major limitation for the execution of these cooperation efforts is the various conflicts between certain countries in the region, such as Turkey and Cyprus or Israel and Lebanon. The silver lining is that perhaps the key for overcoming these conflicts may be the new economic incentive presented by joined gas revenues, as seen in the case of the Caspian Sea shelf.

From an Israeli point of view, there is more than one way to cash in on the gas profits in international relations currency: rehabilitating the relationships with Jordan, Egypt and Turkey by providing them much a needed resource, reaching the European energy market via Turkey, or furthering the cooperation with Cyprus via joint energy projects. The value accumulated through these actions might eventually be greater than the gas's own monetary worth.

A final concern that had largely remained outside the scope of this discussion is the question of Israel's energy independence. Exportation and regional cooperation can strengthen Israel's regional status and create new connections with surrounding countries, but allocating a significant reserve for local use can reduce Israel's reliance on major oil and gas exporters that are still mostly hostile towards it.

List of Speakers

"Natural Gas in the Eastern Mediterranean" Conference

Yossi Abu	CEO, Delek Drilling
MK Avishay Braverman	Economics Affairs Committee Chairman
Yael Cohen-Faran	Director, The Israel Energy Forum
Charles Ellinas	CEO, Cyprus Hydrocarbons
Dr. Oded Eran	Institute for National Security Studies
Prof. Hubert Faustmann	Director, FES Cyprus
Dr. Ahmet Han	Kadir Has University, Republic of Turkey
Simon Henderson	Washington Institute for Near East Policy
Sagi Karni	Foreign Affairs Advisor to the Minister of Energy and Water
Leonidas Kioussis	DG Energy, EU Commission Representative
Sir Michael Leigh	Senior Advisor, The German Marshall Fund
Dr. Roby Nathanson	Director, Macro Center for Political Economics
Dr. Sinaia Netanyahu	Chief Scientist, Ministry of Environmental Protection
MK Amir Peretz	Minister of Environmental Protection

Brig. Gen. (ret.) Israel (Relik) Shafir	CEO, Israel Energy Initiatives
Prof. Eytan Sheshinski	Sir Isaac Wolfson Professor of Public Finance, Hebrew University of Jerusalem
Martin Skancke	Consultant, former Director General in the Ministry of Finance, Norway (responsible for the Government Pension Fund)
Dr. Liudmila Studenikina,	Gubkin Russian State University of Oil and Gas
Maj. Gen. (ret.) Amos Yadlin	Director, Institute for National Security Studies
Bini Zomer	Director, Corporate Affairs, Noble Energy Israel