Israel's Natural Gas Resources: Economic and Strategic Significance

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Over the last decade there have been impressive developments in the three components of Israel's natural gas industry: discovery, transport, and consumption. Early 2009 marked an historic development with the discovery of the Tamar and Dalit gas reservoirs off the Haifa-Hadera coasts. These discoveries joined previous gas discoveries in the Mediterranean (off the coast of Ashkelon) and ensure the continued development of the natural gas sector. A seismic survey from June 2010 indicated a possibility for much larger gas reservoirs, suggesting that Israel might have the potential to become a gas exporter. Natural gas is one of Israel's few natural resources, and may provide it with strategic economic, security, and environmental advantages, and perhaps political as well.[1]

Gas Consumption in Israel

Natural gas consumption in Israel is increasing rapidly. According to the Ministry of National Infrastructures, in 2009 Israel consumed about 4.2 billion cubic meters (bcm), compared with 2.7 bcm in 2007 and 1.6 bcm in 2005. More than half of the natural gas is provided by the Tethys Sea consortium (Israeli gas), and the rest by the Egyptian EMG company. In the summer of 2009, natural gas was the source for 40 percent of Israel's electricity production − a rate similar to that in Britain. Dr. Amit Mor, CEO of Eco Energy, estimates that in the course of this decade, natural gas will comprise around 60 percent of the fuel used to generate electricity. This rate may be even higher unless an additional coal power station is

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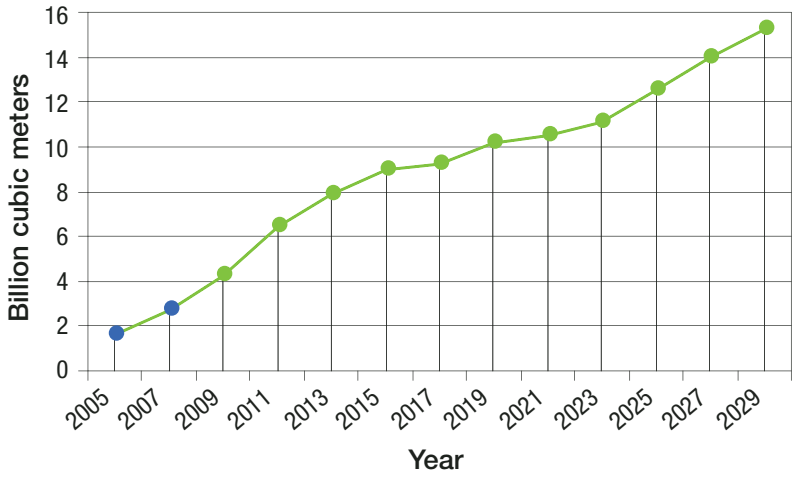
established in Ashkelon. In a related trend, there has been a decrease in the use of oil and oil products in Israel. In 2010, natural gas consumption will replace the need for 4.5 million tons of refined oil. By the end of the year, the Israel Electric Corporation (IEC) gas-operated units are expected to comprise around 55 percent of the company's total capacity.[2]

The Ministry of National Infrastructures forecasts a substantial increase in natural gas consumption in Israel (figure 1): for 2011 – 6.4 bcm (78 percent to generate electricity, and the rest to industry); in 2015 – 9 bcm; and in 2025 more than 11 bcm (two thirds for generating electricity and one third for industry and other purposes). A substantial expansion is also expected in the variety of gas consumers. Other than the needs of the IEC and heavy industry, natural gas can be used as fuel for cars, as an alternative for domestic gas, and as an inexpensive source of energy for desalination.

Figure 1. Natural Gas Consumption in Israel (recent past and forecast)



Source: Ministry of National Infrastructures

Natural gas transportation in Israel is carried out by the national transport system, based in the sea off the coast of Ashkelon. The system connects between the natural gas suppliers and the gas consumers: IEC power plants; private electricity producers; and industrial plants such as Israel Chemicals, Dead Sea Works, Nesher Israeli Cement Enterprises,

the refinery in Ashdod, and the Hadera Paper group. The transport system's network pipes are already about 400 km. The southern part of the gas pipeline system reaches the Dead Sea Works plant and the power plant in Sodom, while the northern section reaches the power plant Hagit (south of Haifa). The underwater section of the system (about 90 km off the shore) supplies the large IEC power stations.

Natural Gas in Israel

Gas fields off the coast of Israel are the main source of natural gas for the local market. The proved gas reserves in these fields[3] are estimated at over 200 bcm (47 times the total natural gas consumption in Israel in 2009), but their estimated potential is much larger. There are three main milestones in the development of the gas sector:

a. *The discovery of gas fields off the coast of Ashkelon between 1999 and 2001*. These fields have provided Israel with natural gas since 2004. In 2009, these reservoirs provided 67 percent of IEC's gas needs. About 15 bcm have already been produced from these fields, and the remainder is estimated at about 20 bcm. Most of the remainder has already been allocated in existing contracts, and is intended to serve the gas sector until the full flow of gas from the new Tamar and Dalit gas fields is in place a few years from now.

b. *Discovery in early 2009 of the Tamar and Dalit gas fields, which are intended to serve the market in the next decades*. Proved gas reserves in the Tamar gas field, located 90 km west of the Haifa coast, are estimated at about 184 bcm, with proved and estimated reserves together estimated at 247 bcm.[4] Deep drilling has been carried out at the Tamar field; for example, Tamar 2 drilling went as deep as 1.7 km and its final depth (including beneath the sea floor) reached 5.1 km. Cost of the field's development is currently estimated at about $2.8 billion.[5] The gas flow should start within a few years, at which time the Tamar field will become a major source of gas supply for the economy. Gas reserves in the Dalit field, located 60 km west of the Hadera coast, are estimated at only 14 billion cubic meters, which decreases the value of developing the field. However, development of the Dalit field can be completed earlier than the Tamar field since drilling is less deep and closer to the coast.

c. *Signs of additional new large gas fields that, if verified, will make Israel a gas exporter*. Such indications appeared in the June 3, 2010

announcement by the Noble Energy Company (partner to the gas discoveries) regarding the initial interpretation of a wide seismic survey conducted in the area. According to the announcement, Noble Energy believes there are favorable prospects for drilling natural gas reserves in the Leviathan structure (Amit and Rachel fields, located west of Tamar) and could reach up to 16 trillion cubic feet (453 bcm), double than in Tamar, as the geological chance of success at the structure is 50 percent. It was also reported that the total potential of gas reserves in the Leviathan and other structures examined in the latest survey is about 850 bcm (in the waters of Israel and Cyprus). However, an estimation of the geological probability of finding gas in other structures has not yet been carried out, and it is possible that it may be lower than in the Leviathan structure.[6] In light of this data, Noble Energy intends to carry out exploratory drilling in the Leviathan structure towards the end of the year.[7] Further reinforcement of the prospects of discovering gas is found in a report by the US Geological Survey institute, which indicates considerable potential of gas and even oil reserves within the layers of the ground underneath the Mediterranean in Israel's region.[8]

The Import of Natural Gas from Egypt

Egypt is the second source of gas for the Israeli economy. Egypt's proved gas reserves are estimated at around 1,655 bcm, about 0.9 percent of the total world reserves.[9] In 2009 the Egyptian company EMG provided 37 percent of IEC's natural gas demand. Egyptian gas is supplied to Israel through an undersea pipeline that runs between el-Arish and the gas import facility in the Ashkelon waters. Natural gas supply is one of the most significant reflections of the economic ties between the countries.

The process of Israel's acquiring gas from Egypt was fairly protracted. In July 2005 an agreement was signed between IEC and EMG to supply about 25 bcm of gas for 15 years at an annual rate of 1.7 bcm. The agreement allows IEC a five-year extension for the same annual quantities under the same conditions. Gas flow began in mid 2008, but by mid June 2009 EMG did not fulfill its obligations. EMG argued that there is a general shortage of gas in Egypt due to delays in developing new production fields, gas demands that are exceeding forecasts, and malfunctions in the supply system. IEC was also asked to raise the price of gas stipulated

in the agreement due to a wide gap between the price appearing in the agreement and the price of gas in the global market. In August 2009 IEC's Board of Directors approved an updated agreement with EMG (according to the changes in the 2005 agreement made by Egypt with EMG). The updated agreement with IEC includes an increased price of natural gas and a system that allows a periodic price increase, reduces the amounts that IEC is obligated to purchase through the agreement, and establishes measures to ensure the reliability of gas supply. EMG has so far fulfilled its supply obligations.[10] Meanwhile, in July 2009 EMG signed an agreement with a private electricity supplier, Dorad Group, to supply 0.75 bcm of natural gas per year for a period of seventeen years.[11]

Additional Potential Sources of Gas in the Area

Natural gas off the coast of Gaza. In May 2000 Prime Minister Ehud Barak granted the Palestinians the option to search for oil and gas off the coast of the Gaza Strip. The Palestinian Authority then granted permission to the British Gas company to carry out offshore drillings off the Gaza coast. In August 2000, natural gas reserves were discovered in the Gaza Marine gas field two kilometers below sea level, totaling more than forty bcm. After field development, the project's earnings were supposed to be distributed as follows: 60 percent to British Gas; 10 percent to the Palestinian Authority investment fund, and 30 percent to a privately owned Lebanese infrastructure company. Since Palestinians gas consumption is generally low, gas field development and gas production are conditioned in its sale to a third party − Israel or Egypt − but negotiations conducted by British Gas did not produce an agreement. To date the field has not been developed due to financial disagreements, concerns that some funds will end up in terrorist organizations hands, the Hamas takeover of the Gaza Strip, and the priority given to the purchase of gas from Egypt rather than from the Palestinians. In February 2009, after a long period where IEC and British Gas were not in contact with one another, the parties met in London to resume negotiations regarding the sale of natural gas from Gaza Marine to IEC, but so far with no reported progress.[12] Under suitable political conditions, Palestinian gas could serve as an important source of energy

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for power stations and water desalination stations that in the future will be constructed within Palestinian territory. Part of it may even find its way into the Israeli market or overseas through Israel (if and when Israel develops an infrastructure for export).

*The option of importing gas from Russia or the republics in the Caspian Sea through Turkey***.** Turkey's geographical location, between countries rich in gas reserves and the European gas consumers, makes it an important junction on the regional gas infrastructure map. For example, the Russian gas pipeline, also referred to as the Blue Stream Pipeline, which brings natural gas into Europe, passes through its territory. In August 2009 Prime Minister Putin announced that Russia and Turkey will examine an option to lay a pipeline that will split off from the Blue Stream pipe and allow export to Israel, Syria, Lebanon, and Cyprus.[13] The discovery of gas in Israel and the updated agreement with Egypt reduced Israel's current need for this option. Therefore, gas imports from Russia, which possesses about 25 percent of the world's proved gas reserves (table 1), or from the republics in the Caspian Sea area may become a long term alternative in case difficulties emerge with existing supply sources. In any case, on June 3, 2010, as a result of the tensions between Turkey and Israel, the Turkish minister of energy and infrastructure said that Turkey will not be developing any joint projects with Israel until normalization between the two countries is restored, and that Turkey has no intention of starting a feasibility study on transportation of water or natural gas to Israel.[14]

The option of importing liquid gas (LNG) from around the world. In order to reduce the dependence of the gas sector on gas suppliers, there are plans for construction of a liquefied natural gas facility with capacity for an annual supply of 4 bcm, which would allow liquid gas suppliers from around the world to bring natural gas into the Israeli market. Under normal conditions, liquid gas imports to Israel are not economically worthwhile. Thus, the main importance of this facility lies in providing a regular supply of gas in case of malfunction on the part of one of the suppliers. To date, six approved entrepreneurs have been approved to bid on constructing the facility.[15]

Table 1. Distribution of the world's proved gas reserves (estimates January 2010)

Country	% of the world's proved gas reserves
Russia	25.4
Iran	15.8
Qatar	13.6
Turkmenistan	4.0
Saudi Arabia	4.0
United States	3.7
Abu Dhabi	3.0
Nigeria	2.8
Venezuela	2.7
Algeria	2.4
Iraq	1.7
Australia	1.7
China	1.6
Indonesia	1.6
Kazakhstan	1.3
Egypt	0.9
Libya	0.8
Other	13.1
World	100

Source: *Oil & Gas Journal*

Israel's Economic Benefits from Natural Gas

There are several advantages to establishing power plants that run on natural gas (table 2). Unlike coal plants, which must be built on the coast – usually a dense and high priced area – gas-powered plants require a relatively small area and can be built anywhere. They are generally much less expensive to build than coal-powered stations. The main drawback of using natural gas over oil and coal is the difficulty in storage and transport in containers. The most effective way to market it is by placing a gas pipeline infrastructure that must be maintained and secured.

It is possible to liquefy natural gas and transport it in tankers, but this involves relatively high costs.

Reducing market costs. Natural gas is the cheapest energy product in the Israeli market and its price is similar to the price of coal. The proximity of gas wells to the local market and the competition between Israeli and Egyptian gas suppliers allow Israeli gas consumers to purchase natural gas at low prices. IEC estimates the cumulative savings to the economy during 2004-2009 from use of natural gas at a total of about 23.5 billion NIS.[16] Following the transition to the use of natural gas, the electricity authority approved a reduction in the prices of electricity starting February 15, 2010 of about 9.3 percent for domestic consumers and 16.3 percent for industrial consumers.

Direct income to the state treasury from use of Israeli gas. In 2009 the state collected nearly 150 million NIS royalties from the use of the Tethys Sea fields off the coast of Ashkelon. However, royalties (12.5 percent gross) are just a part of the state's revenues from gas. The Ministry of Finance estimates that the total value of taxes collected in Israel as a result of natural gas activities (including individual income taxes, corporate tax, and royalties) is about 40 percent of gas value, similar to the situation in Britain. By way of illustration, out of current proved gas reserves whose value is now estimated at $40 billion, over the years the state is expected to receive about $16 billion.[17]

In April 2010 the Ministry of Finance established a committee to examine the state gas royalties earned from discovered gas. The committee had the following mandates:

a. To examine the fiscal system currently used in Israel in regard to oil and gas resources in comparison to countries with similar macroeconomic and democratic characteristics, while taking into account the special geopolitical and economic conditions in Israel.
b. To offer an updated fiscal policy, with reference to the various stages of licensing and disclosure for resource areas found at the time of the committee's establishment.
c. To examine the possible implications of current discoveries as well as future revelations for the Israeli economy.[18]

In other words, at issue is the increase of royalty rates that the state collects from natural gas producers. Investors in search for gas have reservations about the possibility of raising the royalty rate for licenses

and existing discoveries, with considerable sums already invested in seismic surveys and searches. The investors consider it to be "unfair play"[19] and claim that the State of Israel should encourage investments in order to ensure the continued momentum in its oil and gas fields exploration.[20]

The contribution to Israel's balance of payments. The use of Israeli gas will save hundreds of millions of dollars a year earmarked for fuel import. Israel is also expected to gain substantial revenues in foreign currency should it export gas. In other words, discovering gas not only reduces Israel's energy dependence but also its dependence on foreign currency. Even though currently Israel does not suffer from a balance of payments issue and in the short term foreign currency savings even contributes to the shekel's revaluation, which disturbs the economic leaders, the use of Israeli gas is still referred to as a long term strategic advantage that can help reduce the Israeli economy's dependence on overseas markets in difficult times.

Table 2. Electricity Production Costs at Different Power Plants

Burning material in power plant	**Cost of electricity production (kWh) in NIS** (in December 2009 prices)
Gas	0.129
Coal	0.15
Fuel Oil	0.38
Diesel	1.429

Source: IEC, periodic report for 2009

Investments in the energy sector. Consumption of Israeli gas in Israel has revolutionized the local search for gas and oil. The ability of investors to sell the gas at the nearest market has increased their motivation to continue to seek and drill for oil and gas in Israel. As a result, considerable investments are also being made in the transport infrastructure. So far, approximately $1.3 billion have been invested in the natural gas sector, and the expected investment for the next five years is approximately $3.7 billion.[21]

*The environment***.** Natural gas burns relatively cleanly in comparison to other fuels, such as crude oil, diesel, and coal, and it emits fewer

pollutants and greenhouse gases. Improving air quality has a long term economic and social contribution to increased quality of life, decreased morbidity, and so on. Moreover, the effort to reduce greenhouse gas emissions harmful to the atmosphere is currently a leading international priority. The use of gas improves Israel's international status as a state engaged in contributing to the environment.

Reducing Israel's Energy Dependence

More than most countries in the world, the State of Israel has a security interest to reduce its dependence on the import of basic resources such as water, essential food and raw materials, and – in particular – energy. Israel is still in a state of isolation in the Middle East, most of its energy sources are far away, its supply routes are narrow and limited, and in times of conflict foreign ships and tankers might not be able to reach the country's ports. Additionally, Israel may suffer a shortage of energy along with other countries in the world, following events such as a war in the Persian Gulf and instability that could impact on large oil producers. Following the Iranian revolution in 1979, for example, there was a rise in prices as well as difficulty in supplying oil globally.

The "oil weapon" was used by the Arabs in 1974. Although a similar ban is currently not likely, even then it came as a great surprise to the Western world and Israel. At the time it was estimated that Saudi Arabia would not work against the interests of the United States, but eventually it was drawn into Iraq's initiative. Although the current political conditions are totally different, world dependence on Arab and Iranian oil, controlling more than 60 percent of the world's proved reserves, could grow, and in a time span of decades the geopolitical map may change. Even today energy import is a matter of supreme importance in the foreign relations of oil importers. Previously a main issue was Western Europe's dependence on oil imports from the Middle East; it is now joined by East Asian countries like China and India, with rapidly growing markets dependent on oil from abroad. Although energy resources development will not reduce the political pressure caused by oil boycotts on consumers, it will certainly reduce Israel's energy needs. A significant change in the political power of oil producers will occur only when there will be alternatives based on renewable energy.

Israel is currently not dependent on oil for electricity production. Table 3 illustrates that most of the electricity in Israel is produced by coal and natural gas, and the amount of oil used for electricity generation is minimal. However, Israel depends on oil for transportation as well as for raw materials for industry. Further discoveries of natural gas in large quantities may reduce the need for refined oil for transportation by refueling cars with compressed natural gas or by a rise in electricity production, which will provide for electric cars on a large scale. Gas discoveries are also essential in reducing Israel's future dependence on gas imports.

Table 3. Electricity Production in IEC

	2008	**2009**
Coal	64.9%	64.7%
Natural Gas	**26%**	**32.6%**
Fuel Oil	3.1%	1.2%
Diesel	6%	1.5%
Total	100%	100%

Source: IEC, periodic report for 2009

Malfunction in gas supply and transport is one of the leading risks of the resource. It requires a sensitive system that must be secured. To reduce the risk, most power plants converted to gas are supposed to maintain the possibility of being refueled by liquid fuel (dual fuel capability). It is highly important to preserve the system even if it is not used for many years. The second component of the planned gas supply security system is a facility capable of overseas liquid gas absorption, which is expected to be available in the coming years. It would provide security to consumers who do not possess dual fuel systems. The third component is to use the depleting gas field off the coast of Ashkelon (Mary B) as a strategic and operational storage reservoir for natural gas to ensure supplies in case of failure, and allow flexibility in supply when demand peaks. The reservoir will function in this role after the economy will base itself on the gas flow from Tamar. [22]

Developing the gas sector is part of a general strategic effort to reduce the dependence on oil. A related developing area is renewable energy sources. On January 29, 2009 the Israeli government set a target for the production of renewable power amounting to 10 percent of the energy

needed for the country's electricity in 2020 (interim target – 5 percent until 2014). On February 7 the government decided to establish a team of CEOs to formulate a national plan to reduce dependence on oil, headed by the head of the National Economic Council in the Prime Minister's Office, Professor Eugene Kandel. The team should submit its recommendations by August 2010. In this context, Prime Minister Binyamin Netanyahu said:

> The government considers the research, development, and implementation of technologies that reduce the global use of oil-based transportation as a national mission that requires top level national priority...The world becomes aware of oil substitutes for transportation only when the price of oil goes up. When world oil prices go down, the awareness and investments in this field disappear. Therefore, Israel must consistently focus efforts on research and development of oil substitutes and do so consistently, while harnessing other countries that have an interest of freeing themselves from the grip of oil suppliers.

The team was instructed to examine priorities for research and academic and industrial development, and pool governmental resources towards a national effort for developing oil substitutes by cooperating with foreign governments, the private sector, and others.[23]

One related issue is water. A reduction in water prices due to desalination can contribute to solving the water shortage in Israel. It reduces Israel's dependence on natural fresh water resources, and decreases the need for water transportation solutions, such as the project to import water from Turkey discussed in the past. The ability to desalinate water at affordable prices can help lessen political disagreements in the policies of this sensitive area.

Conclusion

Israel is in the midst of a new energy era, marked primarily by an increase in use of natural gas and the accelerated use of renewable energies as a replacement for oil. The use of gas allows savings in energy costs and contributes to the environment.

Of the existing and potential natural gas resources, the gas fields off the coast of Israel are particularly important. Israeli gas has a major role in the following areas: income for the country's treasury, foreign currency savings, increase in the number of investments in Israel, GDP growth,

stable energy supply, and minimizing Israel's dependence on overseas energy resources. As more gas fields are discovered, these advantages will grow in significance and if the latest predictions are realized, Israel will become a gas exporter.

In the regional context, the import of gas from Egypt has a significant political importance due to Egypt's centrality in the relations between the two countries lacking other economic and social normalization aspects. Importing gas from the Palestinian Authority is not currently on the agenda, but in the future it may contribute to the economic development of the Palestinian market, which is an Israeli interest. The use of natural gas increases the feasibility of desalination, therefore helping to reduce the potential of regional conflicts over water.

Notes

1 This article in intended for academic purposes only. The data appearing in it should not be relied upon for any investment or operative needs.
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5 Delek Energy Systems, unaudited financial statements for March 31, 2010, May 25, 2010.
6 Delek Drilling Ltd. partnership and Ratio Oil Exploration Ltd. partnership, note to the Tel Aviv Stock Exchange, June 3, 2010. The companies warn that the given information is a "look into the future" based on assumptions and estimates given to them. At this stage there is no certainty, and they may be updated.
7 Noble Energy, "Noble Energy Announces Highlights of 2010 Analyst Meeting Including Five-Year Production, Reserves, and Capital Outlook," Noble Energy site, June 2, 2010.
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