

Israel

American independent Noble Energy has discovered a world-class natural gas field offshore Israel, changing both its fortune and the fortunes of its host country.

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Israel is the Biblical land of milk and honey, and now it's the modern-day land of milk, honey and natural gas. For in deep waters offshore Israel, in the virtually unexplored Levantine Basin, Houston-based Noble Energy Inc. has discovered a monster gas field.

Indeed, Tamar is the second-largest natural gas find in the world since January 2008, behind only Petrobras' subsalt Jupiter discovery offshore Brazil.

Tamar, stuffed with some 6.3 trillion cubic feet (Tcf) of recoverable gas, was spudded by Noble and its partners, Delek Drilling, Isramco Negev-2, Avner Oil and Dor Gas Exploration, in November 2008. To drill the immense and hugely tempting prospect, Noble had to entice a deepwater rig from offshore West Africa to travel to the eastern Mediterranean.

Noble took a farm-out on Tamar after the previous operator elected not to drill. The quartet of Israeli companies held two licenses—Matan and Michal—but had no illusions they could themselves drill risky, rank wildcats in some 5,500 feet of water.

The Israeli firms needed an experienced, financially sound and technically advanced offshore operator, and Noble fit the bill.

In-country history

Noble had been active in Israel since 1998, when it entered the country via a farm-out. It drilled a successful test on the Noa prospect in the eastern Med in 2,500 feet of water in 1999, and followed that in 2000 with the dramatic 1-Tcf Mari-B discovery. That prospect was drilled on the Ashqelon license, 15 miles off the coast of southern Israel in 800 feet of water.

Mari-B ushered Israel into the natural gas age. With the discovery, the country suddenly had a domestic supply of

the clean, environmentally friendly fuel. Noble and its partners, Delek Drilling and Avner Oil, developed the find through their Yam Tethys partnership, and at the same time began to nurture a national gas market.

Mari-B was a one-off prospect, however. British Gas had made its Gaza Marine find the same year, just across the border between Israel and Gaza. The two Pliocene discoveries inspired a fresh look at the potential of the Levantine Basin, but there were no more analogous prospects.

After its Mari-B success, Noble continued to pursue other ideas offshore Israel. It drilled its rank Hanna-1 wildcat in 2003. "It was dry, but we found out some interesting things," says Susan Cunningham, senior vice president, exploration. "So when Tamar became available in 2006, we were already established in the country, we had operational experience, and we had seen some encouraging signs."

The Tamar opportunity was hardly a slam-dunk, however. Previous operator British Gas had decided against drilling Tamar, and thoughts around the oil patch were that the test would likely encounter extreme pressures and be quite expensive.

"Drilling risks were anticipated to be very high," says Cunningham.

Noble took the Tamar farm-out anyway. The prospect was just too tempting: it presented as a huge four-way structure cut by faults. It was a fairly simple concept of good-quality Miocene reservoir sands draped across an immense feature. The rub was that it was subsalt, lying below some 5,500 feet of tabular evaporites. Mari-B and Gaza Marine were both supra-salt finds, so there was no precedent for a test below the thick salt layer. Undeterred, Noble assumed operations and took a 33% working interest; its current interest in the find is 36%.

The independent was also concerned about pressures, but through painstaking geophysical work it became convinced that the accumulation would actually be normally pressured. Pre-drill, it considered the biggest risk to be reservoir. Just one offshore test, Noble's own Hanna-1, had encountered some reservoir rocks of equivalent age.

Deepwater contractors were understandably reluctant to bring a premium rig to the eastern Med for just one well. Noble had to package some West African wells with the Israeli one to bolster its chances, and it finally secured a commitment from Atwood Oceanics Inc., Houston.

Noble also worked closely with another operator active in West Africa, Kosmos Energy, to ensure that if Tamar did hit, Noble could retain the rig for another prospect, Dalit. Noble's Israeli partners had to make sizeable commitments as well. "It was a good, integrated effort that made everything happen," says David Stover, president and chief operating officer.

The initial Tamar well cost \$140 million and was drilled in 5,500 feet of water some 57 miles from shore to a depth of 16,076 feet. It encountered more than 460 feet of net pay in three fabulous Miocene reservoirs. The discovery

tested 30 million cubic feet of gas a day, constrained by facilities. Production wells will each be capable of making 150 million a day.

The feature covers an astonishing 25,000 acres and boasts a total gas column of 840 feet. Noble and its partners completed the well in January 2009.

Post-discovery

Immediately after making the Tamar discovery, Noble moved the semisubmersible Atwood Hunter to the Dalit prospect. Dalit was on the Michal license, some 28 miles from shore in 4,500 feet of water. At 12,000 feet total depth, it was still subsalt but was shallower and a far smaller feature than Tamar. The license was part of the original Tamar farm-out and interests were identical to those in Tamar.

Dalit was a discovery as well. The wellbore cut more than 110 feet of very high-quality Miocene pay and it flowed 33 million cubic feet per day on a facilities-constrained test. Noble estimated a production well would be capable of making 200 million a day, and that Dalit's recoverable reserves were half a Tcf.

Then, the operator went back to Tamar and drilled a 16,880-foot appraisal well in 5,530 feet of water some 3.5 miles northeast of the discovery. "It came in right as predicted," says Cunningham. Noble cored the appraisal, which was positioned on the flank of the structure. Results were superb, and Noble raised its estimate of recoverable gas to 6.3 Tcf for the Tamar structure alone. Furthermore, the gas is premium quality—it's almost entirely methane, with virtually no impurities. "It's ready to burn," says Stover.

And, Noble is not done yet. After it took the Tamar farm-in, it picked up quite a bit of neighboring acreage. "We wanted to be able to have follow-up running room if Tamar and Dalit worked out," says Cunningham.

All told, the company holds 3 million gross acres in the Levantine Basin. The Tamar and Dalit discoveries were both drilled on preexisting 3-D seismic control. Noble is now shooting 1,200 square miles of new state-of-the-art 3-D seismic on portions of its acreage to flesh out promising leads already highlighted on 2-D data.

Corporate view

Certainly, the discoveries at Tamar and Dalit are fabulous. Tamar is easily the largest discovery in Noble's long and successful history.

"It's not very often you get to be part of an exploration venture that has the potential to dramatically change a country's energy supply," says Chuck Davidson, chairman and chief executive officer.

Indeed, the early news from Tamar was so good as to invite incredulity. There was sand, lots and lots of thick, gas-charged sand. “We kept telling ourselves, it can’t be that good. Those first few days and even weeks we spent a lot of time going through the list of things that might be problems,” says Davidson. “We kept asking ourselves, what don’t we know yet, and what could go wrong?”

Tamar was absolutely that good, and it got even better after the appraisal was drilled.

On a gross basis, Noble and its partners have already invested close to \$300 million in the recent drilling campaign. Development costs will ultimately run upward of \$2 billion gross.

Noble envisions Tamar as a subsea development. Many of these have been done in the deepwater Gulf of Mexico, but Tamar will be quite challenging because the tieback will be exceptionally long, volumes will be colossal, and the project life will be drawn out due to the sheer size of the resource.

“Tamar is a transformational change for Noble Energy. Through these discoveries we are putting legacy-type assets into our portfolio,” he says.

Noble is now managing gross development projects of more than 2 billion barrels equivalent; in the last two and a half years, the company has discovered net resources of more than 700 million barrels in Israel, the deepwater Gulf of Mexico, and offshore West Africa. That’s equivalent to 80% of what Noble had on its books as proven reserves at the end of 2008. The new resources will flow on its books as projects are sanctioned and developed.

And, the very sizeable opportunities that are yet to be drilled on its extensive acreage position offshore Israel could mean more reserves for Noble and much more gas for Israel. Noble’s net remaining undeveloped acreage in the eastern Med is close to the size of 250 Gulf of Mexico blocks, so it’s within the bounds of possibility that Tamar could be the foundation of a thriving gas province. “If we should be so fortunate as to make additional discoveries, then we are looking at more opportunities for the entire region,” says Davidson.

“I’m hopeful that in the end offshore gas will eliminate completely Israel’s need for imported oil for distillate or bunker fuel to generate power,” he says.

“Tamar is a game-changer for Israel, for Noble Energy and for our partners. Our role is to make sure it happens.”

Partner perspective

Successful international operators often emphasize the importance of a strong local partner. Noble came into Israel as a partner with the broader Delek Group Ltd., a Netanya, Israel-based energy and infrastructure group.

Delek had specifically solicited Noble because of its offshore abilities, and Delek in turn has provided the partnership in-country expertise and relationships and helped in the interface with customers and government, from Noble's first well to today.

"It's a partnership that has worked well for us, and we have expanded to other areas of the world with Delek as well," says Noble's Davidson. "It's rare that a partnership lasts beyond a discovery, let alone stays together for two discoveries nearly a decade apart."

After the success at Mari-B, Delek reached into E&P in other regions, including Vietnam, Russia, Africa and the North Sea. In the U.S., it acquired upstream player Elk Resources, based in Denver, and a 60,000-barrel-per-day oil refinery in Tyler, Texas, in 2008. Delek subsidiaries own and operate some 1,600 gas stations and convenience stores throughout the world. In Israel, the group leads the automotive business, holding between 26% and 28% of the market. It was also the first to build an independent power plant in Israel. Delek's strategy is to be in the whole cycle of energy production.

Now it has Tamar. "Tamar is very important and very significant to us," says Gabi Last, chairman of Delek Group. "We are dreaming of a future for Israel where we will use the gas for electricity generation, and also have enough to sell to private houses and as CNG for vehicles."

But the decision to drill Tamar was not an easy one. The well was very costly, and last year was particularly difficult for Delek as well as for other companies, due to the world financial crises. "It was a major investment, and we had sleepless nights. On the other hand, we had our belief in Noble," says Last.

The Tamar discovery has changed the balance in the group. The energy sector has gained in importance, and the company is more focused on the Israeli market. "We came through a difficult year in 2008, and now all our sectors are profitable," he says. "And in the future, because of Tamar, the E&P sector will be one of the leading profitable businesses in the group."

To further strengthen its upstream position, in August the Delek board of directors approved the purchase of up to \$218 million of Noble Energy shares.

"Noble has been on budget, on time, and very professional," says Last. "We are very happy to be its partner."

Future plans

After the Tamar discovery, Noble shifted \$100 million of its 2009 capital program to Israel to cover its costs on the Dalit and Tamar appraisal wells. This year, Noble's total spending in Israel will be close to \$140 million, about 10%

of its total budget.

The company expects to bring another rig back in during the second half of next year and drill through 2011 on both exploration and development wells.

On Tamar itself, its immediate challenge is reaching an agreement with the government on the appropriate place to bring Tamar gas onshore. Coastal real estate is precious in Israel, and several options are being considered. One scenario has the gas coming directly onshore to a new terminal; another option is to feed the gas through the existing infrastructure associated with the Mari-B project. A factor that will become clearer after completion of the new 3-D survey is the location of the most promising undrilled structures, and where they sit in relationship to Tamar.

Israel has become so significant to Noble that the company is scaling up a major project team for the country. Indeed, Israel is one of the very juicy fruits of an effort that Noble launched in 2005, after it completed its acquisition of Patina Oil & Gas Corp. At that time it decided to refocus its exploration efforts on high-impact projects that could make a material difference to the company.

“Tamar has validated that strategy: we have made multiple discoveries in Israel, we have a lot of running room and we have an existing production base,” says Stover.

State of Israel

The impacts of Tamar on Israel are also far-reaching and significant.

“The Tamar discovery provides us the opportunity to independently grow our energy supply for the next 20 to 25 years,” says Uzi Landau, Israel’s Minister of National Infrastructures. “It will be possible to use this gas for our power production, for industries and hopefully also for transportation.”

Israel is already on the path of expanding natural gas use. The country has been rapidly shifting its power-generation sector from reliance on fuel oil to natural gas. Today, up to 40% of Israel’s electric power is generated from natural gas, versus none in 2003. “We also expect 70% of our industries to use natural gas by 2013,” says Landau. On top of that, more tenders are coming to expand Israel’s nascent pipeline grid to cover 90% of the country.

The government is engaged in a structural reform of the monopoly of Israel’s electric sector, and it is encouraging independent power producers. In addition to natural gas, Israel is advocating renewable energy, including wind and solar projects.

“We have been dependent on imports for all of our energy. Now, with Tamar natural gas and renewable energy, we will substantially reduce our dependence on foreign energy suppliers,” says Landau.

Balancing the desire for domestic energy is the practicality of stable and diverse suppliers. Currently Israel has just two gas suppliers, the Yam Tethys partnership that supplies Mari-B gas, and East Mediterranean Gas, which imports Egyptian gas into Israel via pipeline. “On top of that we have a tender for an LNG regasification plant,” he says. “This will provide our economy more access to natural gas.”

For companies interested in investments in Israel, either in its emerging upstream or established industrial sectors, there are many positives to consider.

“We offer a stable and growing economy. We have an efficient, well-regulated banking system, and our legal system is transparent,” says Landau. “And our greatest advantage is human capital. We have a sophisticated, well-trained, innovative workforce. Whatever one might find in the most advanced Western economies one can find here in Israel.

“There are growing hopes that we shall have more discoveries in the vicinity. If this happens in the future, Israel could be more than a consumer. We could possibly even become an exporter of gas.”

Opening an industry

Noble’s Mari-B discovery was the first green shoot of Israel’s gas industry, and the start of a fundamental change in Israel’s energy supply. Noble had its Tcf gas discovery, but Israel had no gas laws, no gas infrastructure and no gas markets.

“We took Mari-B from discovery to production in four years, in a country with no infrastructure whatsoever,” says Stover.

The Mari-B platform can deliver 600 million a day. The wells are horses: just six completions, composed of five dry trees and one subsea well, can make all that gas. The high flow rates have allowed Noble to hold operating costs to less than 25 cents per thousand cubic feet (Mcf), with a development cost of less than 50 cents per Mcf.

And, the company has been actively building gas markets since it drilled the first Mari-B well, says Rodney Cook, senior vice president.

Right after the Mari-B discovery, Noble began to meet with Israel Electric Corp., the state-owned utility that generates almost all of Israel’s power. Noble sold IEC on the benefits of gas, and the utility began to convert some of its boilers to dual fuel.

“We had to create the market, and fortunately for us now the market is starting to grow,” says Cook. The first gas sales were in early 2004, to IEC’s 1,200-megawatt Eshkol power station at Ashdod in southern Israel.

Noble initially brought its Mari-B gas onshore at a temporary facility at the Eshkol facility; now the Yam Tethys partnership has a permanent receiving terminal nearby with capacity of 900 million a day.

IEC has converted existing boilers to dual fuel, added new gas turbines and put in combined-cycle facilities as well. Company-wide, IEC generates about 60% of its electricity with coal. Prior to the availability of natural gas, it used heavy fuel oil in boilers and diesel in turbines. Now IEC has replaced heavy fuel oil with gas in nearly all its plants. Certainly, for the utility, gas is significantly more economically attractive and environmentally friendly than fuel oil.

Israel’s electric sector has been growing rapidly: during the past decade, demand for electricity has jumped between 3% and 6% per year. Even though 2009 is projected to be flat, due to the economic downturn, Israel is going to need much more electricity.

As part of its plans to meet growing demand, IEC is installing three new gas turbines at various places around the country. Eshkol, Noble’s first customer for Yam Tethys gas, is the site of one of those, scheduled to be on line in July 2010, says Amnon Bibi, Eshkol plant superintendent. A combined-cycle power plant is also in the works for 2012-13. The main fuel for both units will be natural gas.

Israel’s average natural gas use is around 400- to 500 million a day, although demand can hit 750- to 800 million a day when the air-conditioning load hits hard in the summer months. Currently, the Yam Tethys partnership supplies about 65% of IEC’s demand and the pipelined Egyptian gas accounts for the remainder. “The Mari-B platform averages sales of 300 to 400 million a day,” says Doug Smith, Israel-based general manager of Noble Energy Mediterranean Ltd. The supply from Egypt runs 150- to 220 million a day.

Noble has stressed its reliability as a gas supplier to IEC and all its customers. “Last year, we met demand 100% of the time; over the life of the project we’ve been more than 99% reliable,” says Smith. Additionally, Noble has had zero security incidents in its decade of working in Israel.

Beyond electricity

Israel’s industrial market is developing as well. The partnership has courted industrial customers, including a new crop of independent power producers. “We are moving forward aggressively to get the Tamar gas contracted,” says Cook.

“Our plan is to penetrate industrial markets, and that will be aided by Israel’s push to extend pipelines into its interior,” says Smith.

Noble can sell directly to high-pressure customers, such as paper mills, refineries, desalination plants and chemical manufacturers. A number of customers that consume from 5- to 20 million cubic feet per day are also looking at cogeneration, which promises to be very big in Israel. Low-pressure customers will (one hopes) be served by an emerging local distribution company sector. Tenders for Israeli LDCs are in the earliest stages.

Noble thinks that the entire Israeli gas market can average 800 million to 1 Bcf a day by the time Tamar is on line. Power generation will continue to burn the bulk of the gas, while the industrial market has the capability of reaching between 200- and 400 million a day.

“When we started with Mari-B we had 25 miles of pipeline from the platform to the shore,” says Bruce Erickson, Israel-based business development manager. “Now the infrastructure is almost all over the country, and we have 6 to 7 Tcf of gas. There’s no supply question, and Israel is very hungry for natural gas and the environmental, economic and efficiency benefits it brings.”

Certainly, Tamar supplies the reason to put infrastructure across the whole country, and that investment will generate more demand. “Long-term, we certainly see the option of developing LDCs and residential and transportation demand. We are very supportive of all these efforts,” says Erickson.

Along this journey, Israel has had to quickly form an environmental and regulatory system for handling natural gas. The country has incorporated both European and U.S. standards for parts of its infrastructure. “We’ve worked together since day one,” says Cook. “As we move forward with Tamar we think we can continue that relationship.”

The company has a sense of urgency to get Tamar on line, to avoid any disruptions in the gas supply to IEC, and to keep gas demand growing.

Noble has produced roughly 50% of Mari-B’s gas, and plans to add compression in the near future to maintain volumes. There is also some talk of converting Mari-B to a gas-storage field in the future, a piece of infrastructure that would enhance Israel’s young gas industry.

In addition, Noa and Noa South, two minor accumulations originally drilled around the same time as Mari-B, may be developed as supplements to the Mari-B supplies before Tamar begins to flow gas.

“Both Noa and Noa South are still there and available, waiting for the right time for us to develop them and bring them into the infrastructure,” says Cook.

“For the state of Israel, we are providing a revenue stream, clean energy, and a secure supply of gas for 15 to 20

years. It's a unique position in the world."

World stage

Tamar is a very positive story for both Noble and Israel, says Colin Lothian, Edinburgh-based lead analyst for Wood Mackenzie's Middle East research team. "It's a hugely significant gas find for both parties. For Noble, Tamar will be key in generating substantial value for it over the next couple of decades. For Israel, it delivers security of supply in a difficult environment."

Much still needs to happen before any gas reaches the Israeli coastline and flows to consumers, he says. "Issues to iron out include gas pricing, and the final development concept and the cost of that development."

Israel's fiscal regime is very attractive, says Lothian. The terms that were offered for the exploration acreage were given at a time when offshore Israel was a frontier. "They were purposely attractive to encourage companies to explore." On a global benchmark basis, Israel's terms are comparable to those in the U.S. Gulf of Mexico. "Of course, terms may evolve through time. But as it stands at the moment, Israel is a great place to do business," he says.

Negotiated gas prices paid by Israeli customers to Noble and its partners and to EMG, the Egyptian supplier, have also jumped dramatically this year. There's been a step change. Previously, average gas-sales prices were about \$3.10 per million Btu. In June 2009, three contracts were signed that raised prices to the high-\$4 range, and up into the mid-\$5 range. "If Tamar can achieve gas prices in that neighborhood, it will be very attractive in value terms."

The 2012 timeline appears optimistic for Tamar gas, and yet may be achieved, says the analyst. Noble has already secured a deepwater drilling unit for its development work, which could have been a chokepoint. Most pressingly, it needs to determine where the landfall will be and where it will tie into the existing infrastructure. Onshore facilities will be needed to enable the gas to move to consumers as well.

That said, there are remarkably few technical issues for such a major discovery in a new basin. Moreover, the economics of gas from Tamar stack up quite favorably compared to other energy-supply options for Israel.

"It's a win-win for all involved," says Lothian. "It's hats off to Noble and its partners."