



Questions About the World's Biggest Natural Gas Field

Posted by [Dave Cohen](#) on June 9, 2006 - 6:41pm

Topic: [Supply/Production](#)

Tags: [iran](#), [lng](#), [north field](#), [peak natural gas](#), [qatar](#), [south pars](#) [[list all tags](#)]

[editor's note, by Dave] Generously, Matt Simmons and SCI have given me permission to reference their report *Simmons Oil Monthly - Qatar*, by Robert A. Kessler, April 24, 2006. Matt wanted me to "alert readers that SCI made a major exception to their strict rules of only sending their institutional research to their institutional clients". My thanks to Matt and SCI for making this report available. I believe it will appear soon on the [Simmons & Company International](#) website. I'll do an update when that happens.

Update [2006-6-11 15:33:22 by Dave]: The SCI report I used for this story is now available there. [Simmons Oil Monthly - Qatar](#) (large pdf warning).

Without much fanfare, Qatar announced a [moratorium](#) on new development of the natural gas North Field basin, a decision that had actually been taken in 2005. At the same time, in a recent presentation by Matt Simmons entitled [Tight Oil Supplies](#), we run into this intriguing slide (#44, big pdf warning).

The slide has a blue background with a red horizontal line. The title 'The World's Largest Gas Field (?)' is in white text at the top. Below the title is a map of the Gulf of Persia region, with the North Field and South Pars gas complexes highlighted in red. To the right of the map is a bulleted list of characteristics and uncertainties. At the bottom left is the source 'Source: worldoil.com' and at the bottom right is the logo for 'SIMMONS & COMPANY INTERNATIONAL'.

- Approximately 100 well-bores drilled thus far.
- Known field characteristics:
 - Complexity
 - Non-homogeneity
 - Lack of fault delineation
- North Field/South Pars: large degree of uncertainty regarding true potential.

*The North Field/South Pars Natural Gas Complex
Figure 1 -- Click to Enlarge*

This report will go into considerable detail about the future role of the North Field/South Pars natural gas field, its size and importance, the reasons for the moratorium and finally important questions about both the geology and proven reserves of the field. As Simmons notes in his slide, there is a "large degree of uncertainty regarding [the] true potential [of this field]". The topic is important regarding the uncommon phrase "peak natural gas" on a global scale. As we know, natural gas production has already [peaked in North America](#).

The Size and Role of North Field

Not only is North Field, which lies in Qatar and its eastern extension, South Pars, which lies in Iran, the biggest natural gas field in the world, it also contains a lot of *non-associated* natural gas. From the EIA's excellent article [Natural Gas Processing: The Crucial Link Between Natural Gas Production and Its Transportation to Market](#), we learn that

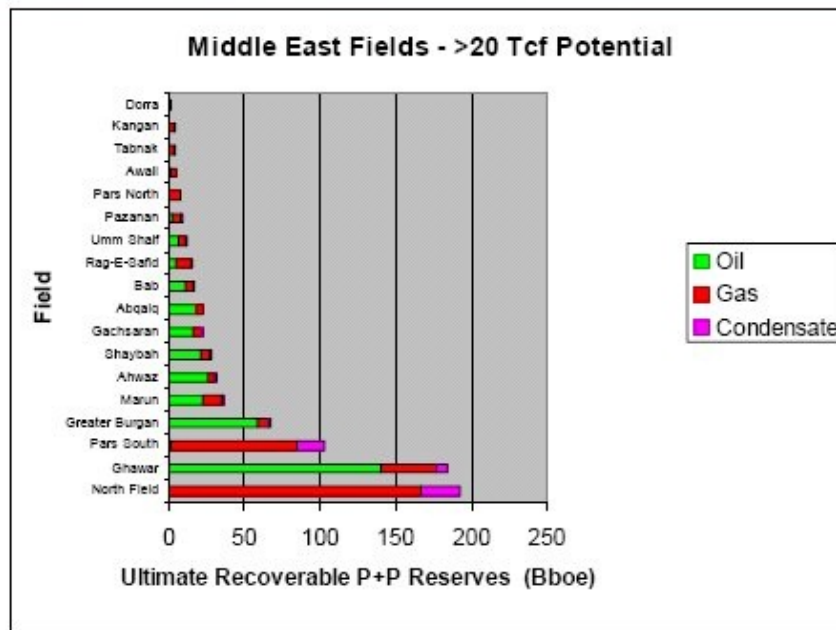
Natural gas processing begins at the wellhead. The composition of the raw natural gas extracted from producing wells depends on the type, depth, and location of the underground deposit and the geology of the area. Oil and natural gas are often found together in the same reservoir. **The natural gas produced from oil wells is generally classified as "associated-dissolved," meaning that the natural gas is associated with or dissolved in crude oil. Natural gas production absent any association with crude oil is classified as "non-associated."** In 2004, 75 percent of U.S. wellhead production of natural gas was non-associated.

Most natural gas production contains, to varying degrees, small (two to eight carbons) hydrocarbon molecules in addition to methane. Although they exist in a gaseous state at underground pressures, these molecules will become liquid (condense) at normal atmospheric pressure. Collectively, they are called condensates....

And as we learn from this IHS report [Middle East Outlook](#) by Stuart Lewis published on March 8th of 2006, that non-associated gas reserves are rare, at least in the Middle East.



Non-associated giant gas fields are rare



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*Middle Eastern Gas Fields
Figure 2 -- Click to Enlarge*

You can easily discern that North Field outpaces all the other fields in the Middle East as regards to natural gas. Here's what the SCI Qatar report has to say about the size of the field.

The North field is currently assumed to contain approximately 900 tcf of recoverable natural gas reserves, accounting for 14% of the 6,337 tcf of worldwide natural gas reserves according to the BP statistical review of world energy. In addition, Iran's South Pars field (a geological extension of Qatar's North field) is estimated to contain 280 tcf of reserves. Taken together, the North field and South Pars are assumed to hold 1,180 tcf of reserves, or roughly 19% of the world total. The North Field covers an area of over 6,000 sq.km, almost half of the surface area of Qatar. Reservoir depth is up to 11,000 feet. Pressure is up to 5,200 psi (350 Barg). The field is a carbonate reservoir with approximate thickness of 1,500 feet (this varies considerably throughout the reservoir).

That's a lot of natural gas. Obviously, the importance of any gas field of this size can not be understated. To put this in perspective, Russia holds the largest percentage of proven gas reserves with 25% of the world's total. This single field alone accounts for 19% of global reserves. And what is to become of all this natural gas? Qatar is ramping up to become the largest LNG (liquified natural gas) exporter in the world. Much of this imported gas [will be exported to the United States](#). At this time, Qatar's liquefaction capacity is 3.4/bcf/d, 14% of the world's total. However, the current plan is to ramp this production up to 10.3/bcf/d by 2011. Qatar's intention is to achieve 100 years of production. The SCI report states that "This would not seem to be much of a challenge on current reserve assumptions and production rates. However, the 320% increase in production capacity planned over the next five to six years will bring Qatar's expected

production to 25 bcfd [billion cubic feet equivalent per day] and the North field's reserve life to 97 years (slightly below the minister's target of 100 years). This leaves little room for error if what is believed to be the world's largest gas field turns out to be anything under 900 tcf". This brings us to the moratorium.

So Why the Moratorium?

Citing the link at the top,

Qatar has put a moratorium on future projects utilizing natural gas from the massive North Field and the freeze is to apparently give Qatar Petroleum (QP) time to conduct field tests on the reserves.

"A decision had been taken sometime ago to freeze any further development in the North Field," Ali Al Hammadi, marketing manager of QP, told the 2nd Middle East liquefied natural gas (LNG) shipping conference here yesterday.

The re-evaluation of the fields should be completed in the 2007/2008 time frame. Another reason for the decision comes from Ahmed Al Klulaifi, the chief operating officer of QatarGas. He notes the fact that there is already a huge effort underway at Ras Laffen to build up Qatar's liquefaction and GTL (gas to liquids) capability. This massive effort leaves little in the way of spare resources and manpower for major operations in untouched parts of the fields. While this explanation seems quite reasonable on the face of it, it would appear that the re-evaluation of the fields is necessary because there are serious questions about the geology of the field and what precisely its proven reserves are. Here's a quote from an [interview](#) with Matt Simmons that succinctly summarizes the situation.

Well, in 2004, if the reports were correct—and I haven't seen any denials—ExxonMobil booked 94% of its reported proven reserve additions as a result of contracts they signed in Qatar for gas from the North Field. Now, the North Field has basically two producing platforms, Alpha and Bravo. And, while ConocoPhillips last summer was drilling the wells for the Charlie platform, they hit dry holes. What's more, the quality of the gas is already sufficiently different, between Alpha and Bravo, that it would appear that the geology of the whole North Field is compartmentalized. In any event, the sheer audacity of the idea that you could have only two producing platforms in such a huge area, and know enough to book 30 years of supply is breathtaking. And we are not talking about some tiny wildcatter here. We are talking about the largest, and theoretically the most conservative, of all the oil companies in the world.

This is in answer to a question about oil & natural gas field reserves accounting practices. Besides from the question of ExxonMobil's dubious bookkeeping, the pertinent information concerns the geology of North Field/South Pars. This brings us to the geology of the field.

The Geology of North Field/South Pars

Recall from *Figure 1* that Simmons characterized the North Field/South Pars geology as *complex, non-homogeneous* and containing a lack of *fault delineation*. Before citing some specific details from the Simmons report, I had asked one of TOD's resident petroleum geologists, Jeffrey Brown,

An ideal field would be one with a very high porosity and permeability reservoir with great continuity, i.e., a pay zone in a well on one side of the field looks like a pay zone in a well on the other side of the field, and there is one continuous, high porosity and high permeability reservoir. Our ideal field could be developed with a minimum number of wellbores, with low decline rates per well.

A less than ideal field would be a series of discrete reservoirs, with little or no continuity between the discrete reservoirs. To fully develop our less than ideal field would require far more wells than the ideal field. Also, given the limited volume in each reservoir, the decline rate per well would be fairly high.

In regard to fault delineation I assume that he means that there is no definite fault trap, but I am not sure.

In summary, I assume that he is saying that the play consists of a bunch of small ("small" in Middle Eastern terms) discrete reservoirs, but I am certainly no expert on Iran [or Qatar].

Apparently, as we see from Jeffrey's description and Simmons' brief remarks quoted above, North Field/South Pars does not seem to be an "ideal" natural gas field. We get more information from the SCI report but not all the details are known.

Regarding *complexity* and *non-homogeneity* (lack of uniformity in the producing underground formations), SCI's best source of information comes from talks with the IOC's (ExxonMobil, ConocoPhillips) working in the area and some SPE papers.

For instance, the IOCs who have booked reserves for the North field don't generally provide precise information on the reserves that have been recorded. This leaves our analysis heavily dependent on conversations with various IOC executives. Still, these conversations have been illuminating. **For instance, we find no support for the myth that the North field is a single, large, homogenous structure. To the contrary, several industry representatives, including CEOs of two of the five largest IOCs in the world have represented that the field is complex and non-homogenous.** Meanwhile, conversations with other industry representatives indicate that new assumptions have emerged about the North field structure over the past two to three years and that those assumptions imply a more complex reservoir than what was previously assumed to be the case. **Non-uniformity applies to the different [Khuff formations](#). It is generally assumed that developments to date have favored the highly productive and liquids-rich zone 4 from the Khuff formation. This leaves a higher degree of uncertainty with regard to production capabilities from the shallower three zones.**

Regarding the "disappointing drilling results", the report confirms Simmons' remark saying "that ConocoPhillips drilled an unexpected dry hole in the North Field and that this event was at least a partial catalyst for a revamped perspective on the North field structure and potential [ie. the moratorium and re-evaluation]". This raises questions about the actual proven reserves.

Meanwhile, in 2005, COP [ConocoPhillips] recorded 1,212 bcf of natural gas reserves and 21 mmmboe of NGLs in this business segment, noting that these additions were primarily attributable to Qatar. These amounts equate to 33% of COP's 2005 organic reserve additions, without which COP would have reported a 67% RRR [Reserves Replacement Ratio] for 2005. **A 93% expense rate on exploration costs incurred would imply that the company is basically taking it on faith that these reserves are proven.** The obvious unknown offset is what well specific information the Qataris might have provided COP in order to book these reserves. Such information is required by the SEC in order to book reserves as proven. Meanwhile, other IOC operators in Qatar have referred to the North field as one of the **least delineated natural gas fields in their portfolio of proven reserves.**

[editor's note, by Dave] RRR Reserves change during the year, before the deduction of production, divided by production during the year. An annual RRR of 100% indicates full replacement of production by reserve additions for that year. [Source](#).

The SCI report goes on to discuss well productivity for the three main rigs Alpha, Bravo and Charlie but reliable information is hard to pin down. Concluding this section, we find that there are serious questions about the geology and proven reserves of the world's largest natural gas field. Naturally, difficult geology will make for much higher production costs going forward, requires more resources (wells) and slows the rate of production.

A Final Note on Ghawar and Iranian Gas Production

Meanwhile, Simmons is also concerned about natural gas production in Saudi Arabia.

Getting Gas In Saudi Arabia Increasingly Complex

- Most of Saudi Arabia's gas comes from its oil fields.
- All mature fields now developing gas caps.
- Dry gas underlying Ghawar has been disappointing.
- Khuff contains 75% of usable non-associated gas:
 - It is deep
 - Rocks are tight
 - Gas is sour
 - Acidizing mandatory
 - Pressure drops fast



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*Gas Production in Saudi Arabia
Figure 3 -- Click to Enlarge*

And generally, his presentation mentions "peak natural gas" more prominently than I've seen in previous talks based on his analysis of resources in the Middle East.

Finally, as regards South Pars in Iran, the EIA notes in their [Persian Gulf Fact Sheet](#) that

Development of South Pars is Iran's largest energy project, already having attracted around \$15 billion in investment. Natural gas from South Pars largely is slated to be shipped north via the planned 56-inch, 300-mile, \$500 million, IGAT-3 pipeline, as well as planned IGAT-4 and IGAT-5 lines....

However, more recent [news](#) notes that

GdF [Gaz de France] will invest in the project alongside French oil major Total SA (TOT) and Malaysian oil and gas company Petronas Gas Bhd. (6033.KU), which will be operator on the field once exploration starts, Bayle told reporters during a lunch at the World Gas Conference in Amsterdam.

Iran owns the world's second-largest natural gas reserves, thanks to the South Pars field, which is shared with Qatar. But while Qatar is exploiting its part of the field, Iran hasn't yet decided to launch the exploration phase.

"We've been told Iran will make its so-called final investment decision by the end of the year, but this may be delayed," Bayle said.

So, it's not clear what the status of development is in South Pars and as usual the Iranians are mum on the subject. Finally, we see these disturbing quotes from the Lewis IHS report presentation cited above: "Iran needs some 1 bcm/d of gas for its own domestic use, **which means there is no surplus gas for export gas in the next twenty years**" - Kamal Daneshyar, Chair of Energy Commission of Majlis (07/05) and "**Gas export is one of the objectives to be pursued** within the frame of 'Iran's 20-year prospect plan'" - Roknoddin Javadi, MD of National Iranian Gas Export Company (07/05)". So the status of Iran's natural gas exports and the development of the South Pars extension to North Field is up in the air as things currently stand.

If you've gotten this far, congratulations. It is just these kinds of issues that the world will confront as we face the inevitable peaking of natural gas. But when that will happen is unknown and hard to predict.



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