The Future of Global Oil Supply: Saudi Arabia

by Julian Darley
julian@postcarbon.org

The new millennium has not exactly been one of 'irrational exuberance' for the oil industry, despite high oil prices. Major oil discoveries have declined every year so that 2003 saw no new field over 500 million barrels, and in 2001 and 2002 the top ten non-state oil companies spent more on exploration than they discovered in value, a new and alarming record. It is well over twenty years since more oil was found than consumed in a year.

From the outset of 2004, large reserve write-downs, starting with Shell, and including El Paso and BP, have shaken the confidence of the financial community, set in motion an official SEC enquiry, and may yet be just the tip of the iceberg.

Comforting then to know that the Middle East, producer of last resort and future saviour of the world oil system, still has nearly 700 billion barrels of reserves, and is publicly confident that it can deliver the required doubling of output to 40 million barrels a day by 2025.

Even more reassuring, Saudi Arabia says it can happily deliver 10 million barrels a day for at least the next fifty years, possibly even rising to 15 million barrels a day - and still for fifty years. This output can be guaranteed because Saudi 'oil in place' will rise to 900 billion barrels by 2025, while new technology will help existing recovery and lead to many new discoveries. This was the message from Saudi Aramco, delivered on February 24 th, at CSIS (Center for Strategic and International Studies), a well-known think-tank in Washington DC, to an audience of diplomats, CIA, EIA (Energy Administration Agency, part of the US Department of Energy), media of record, and many energy companies and analysts of every stripe.

The trouble is that the Saudi Aramco presentations of Mahmoud Abdul-Baqi, Vice President of Exploration, and Nansen Saleri, Manager of Reservoir Management, seemed to be describing not just another country, but another planet when compared with what Matt Simmons, President of Simmons and Co (the world's largest private energy investment banker) had to say. Industry observers noted that Aramco had never before said so much about their reserves and how they hold production steady in their ageing oil fields, but much of the Aramco presentation concentrated on the benefits of new technology, especially in their medium-sized fields, and the possibilities of future discoveries, without noting that well productivity had fallen by more than half since the early 1970s. More than half of Saudi Arabia's oil comes from one giant field, Ghawar, the largest ever discovered, and the health of this field is now in serious doubt, after decades of water injection to maintain pressure

Simmons' case rests on the painstaking analysis of two hundred SPE (Society of Petroleum Engineers) reports written over four decades by Saudi petroleum reservoir engineers, as well as a fact-finding mission in 2003, and ten years of other detailed studies of oil and gas depletion. He has been publicly hinting for more than a year that assumptions about Saudi Arabia's seemingly limitless capacity may be misplaced, but

now, ahead of the publication of his forthcoming book on Saudi oil, the hints have been replaced by copious data and a dire warning

Simmons noted that "in an era of poor energy data, OPEC is a total vacuum," but his latest work on Saudi Arabia does come at a time, when despite more than two decades of official secrecy, questions are being asked about Middle East capacity and reserves, especially since the surprise OPEC cut in production in February 2004

ASPO has recently analysed the extraordinary OPEC reserve revisions of the 1980s, which saw volumes leap from 353.6 billion barrels in 1982 to 643.5 billion in 1990 despite no new large discoveries. Two different ASPO studies conclude that reserves are somewhere between 100 and 300 billion barrels smaller than officially claimed. Evidence from widespread and dramatic falls in well productivity suggests that reserves may now be about what they were stated to be in 1982. This would fit with the original numbers being understated by about thirty percent, and seeing about this much produced in the intervening twenty years. (See ASPO Newsletter March 2004, http://asponews.org.) Simmons' new work on Saudi Arabia, the greatest of all oil provinces appears to have lit the fire under a fast growing mass of evidence that the Middle East is no longer capable of increasing production at will either to stabilise price or make up for sudden falls in other producers

However, a major point of Simmons' work is that knowing when Saudi Arabia is in permanent decline will be very difficult to discern for some time. Despite Saudi Arabia's central role in world oil, there is no official agreement on how much it is actually producing (and this also applies to OPEC in general). Aramco's own report of 6.79 million b/d in 2002 was notably lower than either the IEA or press reports. This has led some to try to estimate production from tanker traffic. The OECD reported that Saudi exports were flat from 2000 to 2002, but Simmons questions how we can be sure of this

During the question and answer period which followed all the presentations, Simmons was noticeably reticent about when Saudi Arabia would peak, but did note that Saudi Aramco had briefly produced over ten million barrels a day in 1981. Afterwards, however he was more forthcoming. "We could be on the verge of seeing a collapse of thirty or forty percent of their production in the imminent future, and imminent means sometime in the next three to five years - but it could even be tomorrow." Simmons asks why the Saudis are expending so much effort on the old reservoirs if they have so many new ones in the wings, many of which have not even been tested. Could the reason be that many of the other 300 recognized reservoirs "seem to lack permeability, porosity, or aquifer - or all three"? The 'Big Five' (Ghawar, Safaniyah, Hanifa, Khafji and Shuaiba) giant oil fields, all found by the mid 1960s, produced 90% of all Saudi oil in the last half century, but now, Simmons said, they were only being kept going by massive water injection, so that the "sweep of easy conventional oil flow is ending."

This may be most alarmingly true for Ghawar. According to Saudi Aramco, Ghawar is only 48% depleted, though they do admit that the northern and most productive region is 60% down. Simmons says that if Aramco's 1975 reservoir estimate of 60 billion barrels is correct, and he intimates that it is, then Ghawar is in fact 90% drained

Many of the other large productive fields have a litany of problems, including sand control and water cut struggles in Safaniyah's northern end, and hydrogen sulphide and pressure drops in Marjan. The next generation of production from Qatif, Abu Sa'fah, and Khurais all have "complex production histories and each has its own set of challenges." For all the Saudi insistence on the importance of technology, according to Simmons "Aramco's reservoir models failed to predict accurate fluid behaviour" fifteen years ago, and he wonders whether their new models will do any better. The knowledge now gained might have caused Aramco to manage its reservoirs differently in the 1960s and 1970s, when it first started peripheral water injection, which could have led to less oil being "by-passed" and left behind. However, hindsight will not help Ghawar now

Another key cause for Simmons' concern is the increasing use of MRC wells (Maximum Reservoir Contact) or "bottle brush" wells, which he says "now anchor future oil production". These wells send out many offshoots into the reservoir: "in simple terms, they hide from top side gas and bottom end water". They can certainly produce oil more quickly, especially from "the last thinning columns of easy oil", but they rarely increase the total yield, and invariably hasten decline and increase its rate. This is the same technology that led to the infamous production collapse of Oman's Yibal field, which "after 30 years of water injection pressure maintenance, embraced horizontal drills in 1990, then peaked in 1997 [at 225,000 b/d] and saw production fall by 65% by 2001. The collapse was a total surprise". In 2004, production has fallen by another 50%. Yibal constituted almost a quarter of Oman's production in 1997

Waving a wad of SPE reports, Simmons went on, "what worries me is these 200 hundred papers because they've basically been written by all their [Aramco] colleagues. They really describe a blizzarding trail of problem after problem after problem - and what we heard today [from Saudi Aramco] is 'we have no problems'." Indeed Aramco stressed throughout their presentation that whatever the market wants they can deliver, and talked frequently of how the "tank" of Saudi oil would expand, thanks to exploration, "delineation", and more technology. Yet Simmons pointed out that much of Saudi Arabia lies outside the "endowment horseshoe", which contains all the great Middle East oil fields, and compared this situation with past, unfortunate US experience: "for years we knew we had the giant fields on the California coast, we knew we had West Texas. A lot of people thought there must be stuff in between if we'd just drill for it. There wasn't."

As for technology, Simmons says that "instead of creating easy supply growth, the technology revolution created monstrous decline rates". Monstrous means up to 20% a year, as in the case of Yibal, yet Aramco shows that Saudi depletion rates are generally lower than those of many other large producers. However, as an example of differences of interpretation perhaps, Aramco shows fallen giant Yibal as 4.3% annual depletion, in company with Prudhoe Bay and East Texas but less than half of a fast decliner like Brent. For the whole of Saudi Arabia, over its entire production history Aramco claims 28% depletion. This is plainly incompatible with Simmons' findings The two different reports presented by Simmons and Aramco are so utterly divergent that they are polar opposites, so that there seems to be no room for a middle ground. Either the Saudis are in the right direction or Matt Simmons is. Simmons was one of the first in the world to begin to comment loudly on global oil peak, after he

discovered that the North Sea giant fields of Forties, Brent, and Ekofisk had peaked and already declined to midgets without anyone really noticing. Simmons and his staff have carried out some of the most meticulously detailed studies of US oil depletion, and he has been proved right concerning his prediction of North American natural gas peak. "Non-renewable things do some day peak, and there is some chance that that might be in the past tense. Scoffing at the notion is today, in my opinion, frankly naïve."

Simmons, along with many others, is calling for a "new era of true energy transparency", in which trust and "flying blind" is replaced by "timely field-by-field production and well-by-well data, budget details, third-party engineering reports" from OPEC. But other parties are also implicated: there must be "far better demand and cost data, and far better decline data for non-OPEC oil" from the IEA [International Energy Agency], and financial reforms are needed to tame "wild price volatility" - there must be "a realistic economic model for how oil and gas needs to be priced." However, there are many reasons why none of the above will happen, not least, that if the Saudi situation is as bad as Simmons portrays, then it is facing economic and social catastrophe in the near future, and will be unwilling to advertise the fact. Other Middle Eastern countries may not be much better off

"I think we should worry about the future", said Simmons after his presentation. "I think we should basically look at this like we looked at nuclear warfare and say that would be so awful if it happened - let's do something, put in a warning system." Referring to Saudi claims of decades of future supply, Simmons said "we're just stupid as a society to say 'now I know we don't have any problems'. Fifty years is great if that's right. But if it's wrong, that's awful." If the Saudis are right, the industrial world has decades more of abundant and cheap oil. If Matt Simmons is right the world is almost certainly in for global oil production decline before the end of the decade. Taken together with the baseless 1980s Middle East reserves increases and no new mega-finds elsewhere, this will most likely signal the end of the oil age