The Oil Drum
DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

Jeremy Gilbert's Comments on TOD Saudi Analysis

Posted by Stuart Staniford on April 12, 2007 - 9:47pm
Topic: Alternative energy
Tags: ghawar, peak oil, saudi arabia [list all tags]

Jeremy Gilbert is the retired Chief Petroleum Engineer at British Petroleum. His biography as an ASPO speaker says

> Born and educated in Ireland. Moderatorship in Mathematics from Dublin University. Joined BP in 1964, worked as production engineer in Libya and then helped introduce the new technique of reservoir simulation into BP - working in Libya, US, Kuwait and Abu Dhabi - prior to eight years in Iran in reservoir engineering posts and as Planning Manager. From 1979, supervised BP's North Sea reservoir engineering and later managed all BP's UK petroleum and reservoir engineering activities. Worked in San Francisco as Vice President of BP Alaska Exploration before returning to UK in 1987 as Technical Manager for the development of Wytch Farm field. Appointed BP's Chief Petroleum Engineer, responsible for the company's worldwide petroleum engineering performance and for an associated R. and D. program, in 1988; later became Resource Development Manger, overseeing technical recruitment and helping design and implement the 'Challenge' program for new staff.
>
> In subsequent posts worked on a range of staff development, equity and major legal issues in London, Houston and Anchorage. Retired from BP in 2001. Is now Managing Director of Barrelmore Ltd., a company providing technical audit and training support to the oil industry worldwide. Has been Chairman of Heriot-Watt University (Edinburgh)'s Industrial Advisory Board, a member of ImperialCollege (London)'s and of University of Alaska (Fairbanks)'s Industrial Advisory Boards, an external examiner for Masters' courses at Robert Gordon's University (Aberdeen) and Heriot-Watt Universities. Has also occupied several significant posts in the Society of Petroleum Engineers, including that of Chairman of the London Section. Lives in West Cork, Ireland - where he and his wife own a bookshop.

Steve Andrews and Randy Udall at ASPO-USA asked him to comment on recent Saudi Arabia discussions here at TOD. The verdict? Read on...

Recall that we have been intensively discussing the status of Saudi Arabian oil production, and in particular Ghawar. The posts in question are these:

- SS: Saudi Arabian Oil Declines 8% in 2006
- EM: Saudi Arabia and that $1000 Bet
- SS: A Nosedive Toward the Desert
- EM: Saudi Production Laid Bare
- SS: Water In the Gas Tank

- HO: Of Oil Supply trains and a thought on Ain Dar
- SS: Further Saudi Arabia Discussions
- SS: The Status of North Ghawar
- HO: Simple mathematics - The Saudi reserves, GOSPs and water injection
- Ace: Further Evidence of Saudi Arabia's Oil Production Decline

I have been out of town for a few days and am not yet caught up on the discussion, so don't have anything new and substantive to add. However, in the meantime, Jeremy Gilbert weighed in as follows (and yes, this is who Dave Cohen was referring to). This is taken from an email to Randy Udall, but Jeremy gave me permission to post it here.

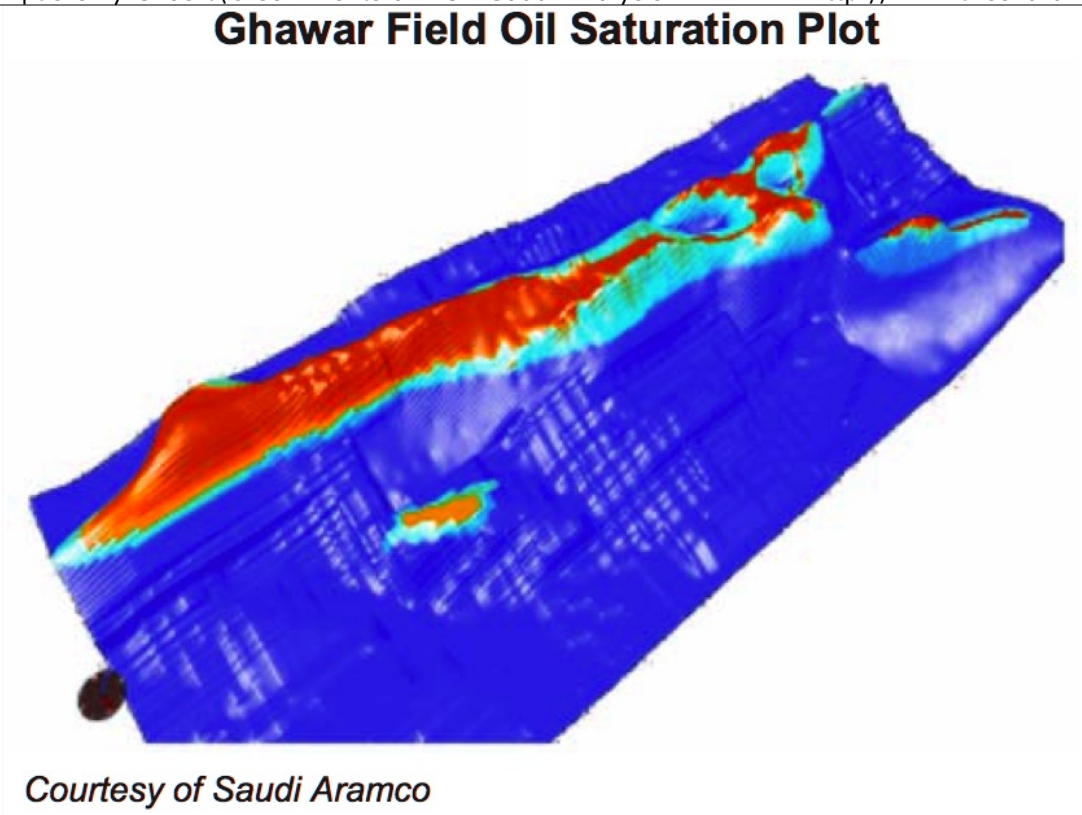
> Lots of questions - not so many easy answers!
>
> Yes, I have read through the Oil Drum articles and comments and also the Peak Oil News article.
>
> I am amazed at the energy and diligence which the authors exhibit in carrying out their analyses. It is, of course, almost tragic that the Saudis won't release more detailed performance data - and their own analyses - which would show the situation clearly and avoid the need for the painstaking work reported in Oil Drum. The conclusions reported seem to me to be credible but I have to emphasise that in any reservoir engineering analysis there are almost always more unknowns than equations. As a result, one is generally faced with having to make estimates for part of the solution and then be concerned about the uniqueness of the solution derived. This is a situation which users of complex reservoir simulators are continually faced with.
>
> It seems likely to me that the conclusions the authors have reached about Ghawar's current status are broadly correct. However, it's a big step to take from concluding Ghawar is currently at or close to maximum achievable production rate to saying that that rate cannot be maintained, or even increased, through the addition of additional production wells, through increased or more efficient water injection schemes or through surface facility modifications. Oil companies employ reservoir engineers and reservoir geologists, and use massive numerical analyses, to deal with just the situation we probably have here: "a mature field is showing signs of declining production with its current development, what can we do profitably which will change this situation?"
>
> Does the situation which the Oil Drum people have described mean that Ghawar's production rate is about to decline? Possibly, but not necessarily. It depends on the amount of additional investment that would be required to address the problem and whether the cost of this work is economically justifiable. The answer to that depends a lot on the oil price scenario which the company has adopted.
>
> I think the problem with what the authors are doing is that they have got to the limit of what can be achieved by well-meaning amateurs who have limited access to geological and reservoir data. Any more detailed analysis requires reservoir engineering expertise and better data. Sorry, but in my opinion it's just not possible for the authors to produce results which are as definitive and reliable as those produced by Saudi Aramco's professionals; they are the people who will decide Ghawar's future.
>
> Now for your 'separate' queries!

1. Reservoir Modelling prior to project sanction.

Right from the time a successful discovery well is drilled the geologists will put together a 'whole earth' model, using PETREL or similar software. This contains all the geological and petrophysical data available and is continually updated as more data is collected. Reservoir engineers will upscale the 'whole earth' model to produce a less complex (smaller) model which can be used to simulator the future performance of the reservoir. Over the years when the field is being appraised hundreds of prediction runs will be made showing how recovery efficiency can be influenced by varying well numbers, well locations, well completions, pressure maintenance and gas/water flooding, different production profiles. The best of these prediction runs will be used as the basis for making a decision on whether or not to proceed with field development; the total cost of the development will be assessed, the future production defined; DCF analysis can be used to decide if the project would be profitable - and to rank this project against others that the company is considering. Once the company's board have approved the project and development drilling begins the numerical model will be continually updated with many prediction runs being made. These will continue through field's producing life as history matching becomes possible.

Although BP's geologists forecast 13 billion barrels of recovery from Prudhoe, the field facilities and TAPS were designed for reserves of 9 billion. Field life was predicted to be about 25 years at the time of sanction. The field stayed on plateau longer than predicted and the decline rate post-plateau was much less than had been predicted.

Also, this is totally unrelated, but I'm putting it here for the sake of somewhere to put it. Various folks were complaining about the Linux supercluster oil saturation picture having the opposite color convention from the various SPE paper cross sections. On the plane earlier this week, I had time to do a little image processing code, and here's a better one:



Oil saturation in reservoir simulation of all of Ghawar. Simulated date unknown but believed not later than 2004. Color scale has been reversed from original by swapping red and blue bytes, and then doubling the distance between red and the average of green and blue for those pixels were the red value was greater than that average. Click to enlarge. Source: Figure 3 of Linux Clusters Driving Step Changes in Interpretation, Simulation.