

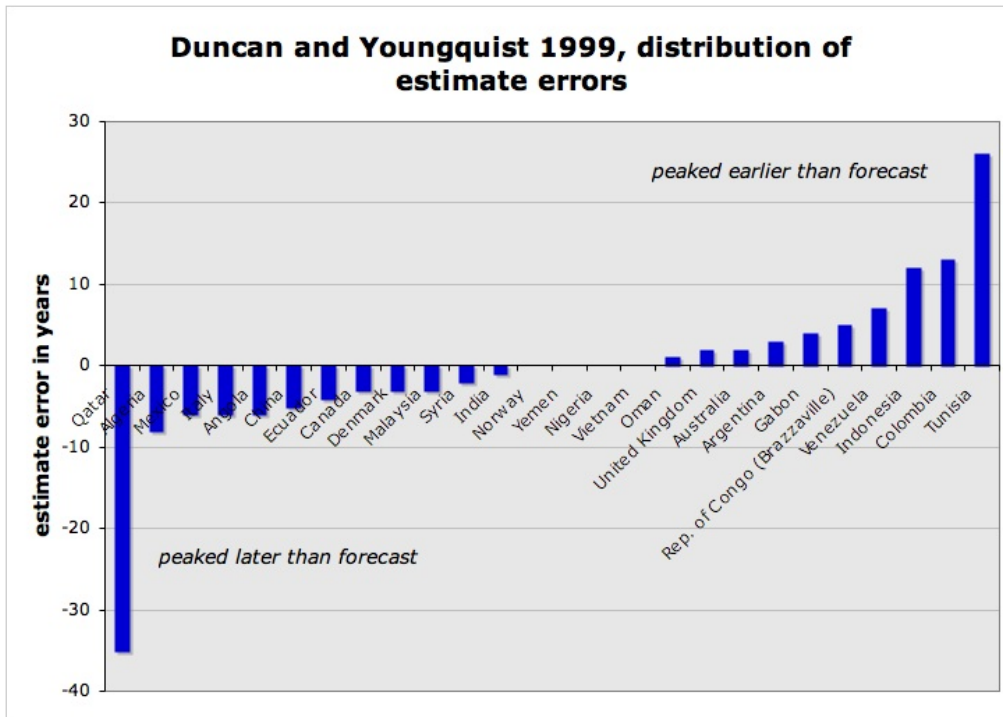


Encircling the peak of world oil production - an evaluation

Posted by [Euan Mearns](#) on July 6, 2009 - 10:02am in [The Oil Drum: Europe](#)

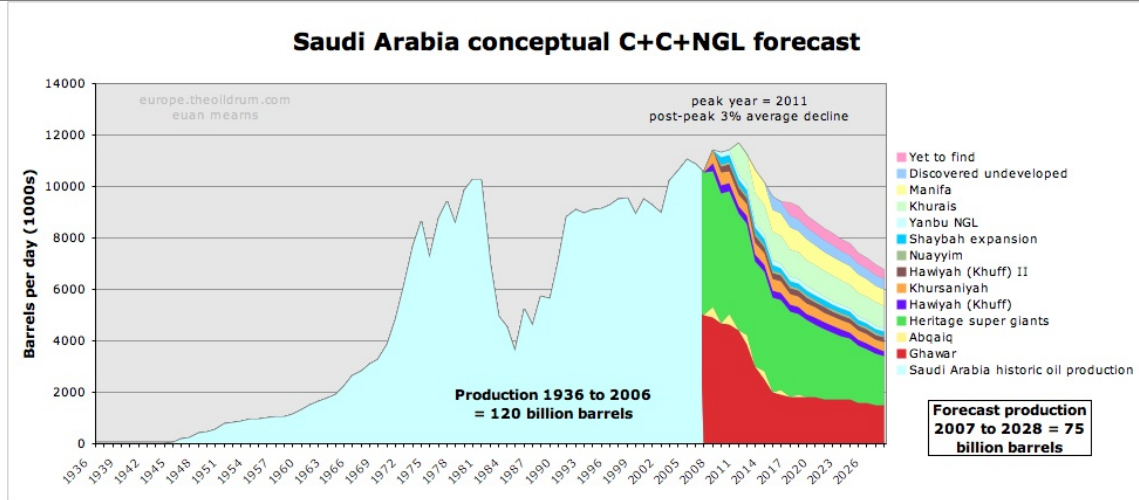
Topic: [Supply/Production](#)

Tags: [encircling the peak](#), [forecast](#), [peak oil](#), [richard duncan](#), [walter yougquist](#) [[list all tags](#)]



In a recent post Nate brought to our attention the work of Richard Duncan and Walter Youngquist published in 1999 in a paper called [Encircling the Peak of World Oil Production](#). In 2007 I performed a simple analysis of the reliability of their forecasts for 26 countries (out of 42 country forecasts that were published) that were checked against what had actually come to pass as documented in [the BP statistical review of world energy](#). The results are shown above. The sum of the differences is -7 years which on average is -0.3 years per country.

At the ASPO conference in Houston, October 2007, I gave a presentation on [Saudi Oil reserves and a production forecast](#) that was born out of several posts by Stuart Staniford, myself and others which are linked at the end of this article. In my talk (which can be found [here](#) on the ASPO server) I presented the forecast shown below and afterwards an elderly gentleman who I did not know at that time, was keen to show me a paper that he and Richard Duncan had published some 8 years earlier that was titled "Encircling the peak of World Oil Production". The gentleman, who I would later learn was Walter Youngquist wanted to show me that their forecast for peak Saudi oil production was 2011, the same date which I had determined from a rather different approach.



On my way home, sitting on the plane sipping the first of many G&Ts I read the paper and realised that the reliability of Duncan and Youngquist's forecasts could be tested. Eight years had passed since their forecasts were made and it was possible to verify their forecasts with what had actually come to pass. I just happened to have a copy of the 2007 BP statistical review on my lap top and so I set to work.

Duncan and Youngquist list 42 countries representing 98% of global production in Table 1. Of those, 8 countries were already past peak at the time the paper was written and a further 5 countries were forecast to peak some time after 2007 (the year I first looked at this data), those being Brazil, Iraq, Kuwait, Saudi Arabia and the UAE. A further 3 countries are not listed by BP leaving a group of 26 countries that were forecast to peak between 1999 and 2007. I have just updated this exercise using the 2009 statistical review.

I compared Duncan and Youngquist's forecast date with actual peak dates for individual countries. The distribution of these differences are shown in the chart up top. Once I had sorted the data I realised the most significant point was the rough normal distribution and that countries that had been "overestimated" were balanced by countries where an "underestimate" had been made. Summing the differences yields a value of -7 years when averaged for the 26 countries yields -0.3 years or - 4 months per country forecast. Weighting the countries for annual production reduces this bias further. This is a remarkable achievement. Their methodology is as follows:

The software ("tool") used for the conclusions expressed in this paper, we have termed the "World Oil Forecasting Program" which consists of two distinct, stand-alone models for each nation.

The Numeric Forecasting Model

The first model ("N model") is quantitative, using production data and mathematics on a translated coordinate system to produce an intermediate "helper" forecast for each nation. This, the so-called "guide" forecast ("G forecast"), is a purely mechanical prediction of future production. In some examples, the G forecast can provide useful information about the shape of future oil production by providing a lower boundary on the estimated ultimate recovery (EUR) and the probable shape of the future production curve. However, in other circumstances, it is not useful, as in the situation of the OPEC production quota-limited countries. The N model produces the G forecast, the best forecast we are able to make based solely on historic production data, and mathematics. Data are from British Petroleum (1968-1997) and Campbell (1991). Details are in Duncan (1996).

The guide forecast is just one of many items of information that may be used in the second model portion of the World Oil Forecasting Program.

The Heuristic Forecasting Model

By definition, "heuristic" denotes a method of solving a problem for which no algorithm exists. It involves trial and error, as in iteration. In this discussion heuristic knowledge indicates "soft," "qualitative," or "judgmental" knowledge. Although judgmental knowledge is lacking in the Numeric model, it is crucial for oil forecasting in the heuristic model ("H model"). The H model provides the user with a powerful interface for oil forecasting, chief of which is a three-curve graph for each nation with years 1960 to 2040 on the x axis, and production on the y axis (Fig. 1. Curve 1 shows the historic data from 1960 through 1996—a crucial reference for forecasting. Curve 2 shows the guide forecast (previously discussed) and is useful as the lower bound curve. Curves 1 and 2 are important forecasting aids, but they are only the beginning.

Curve 3 also displays the historic data from 1960 through 1996, but this time the data serve as a base for a new and better forecast 1997 through 2040. A so-called graphical input device (GID) makes it easy to enter and run different trial forecasts. After each trial run, a different estimated ultimate recovery (EUR) value is displayed so, after making several runs, the user can select an upper-bound curve for each nation. Thus, now confined by lower and upper curves, and further modified by judgmental input, the user extends the most recent production trend seamlessly into the curve extending through the year 2040, providing what we termed the "judgmental" forecast (J forecast) of future oil production, one nation at a time. Details of the heuristic model are in Duncan (1997).

In our 42-nation study, we also have grouped the nations into seven regions (Figs. 2-8 and Table 2), and made a world summary (Fig. 1 and Table 1), which are the output of the heuristic model."

Anyone who has ever attempted to forecast oil or gas production will know that the minute the forecast is published you think of something you missed or a better way to do it. It is not an easy task working with numerous, often poorly constrained variables. Duncan and Younquist did make some mistakes, notably Qatar where I imagine they underestimated natural gas liquid production from the North Field and Tunisia where they anticipated a second peak in 2009, that did materialise in 2007 but failed to exceed the earlier peak of 1980. The important thing is that the errors are not biased.

To the 5 countries forecast to peak beyond 2008 that are listed above we have to add Angola, Qatar and China which set records in 2008 and which may yet have a future peak date This on-going uncertainty is not incorporated in the analysis of Duncan and Younquist's forecasts where the difference recorded is that between their forecast dates and 2008.

Duncan and Youngquist forecast that world oil production would peak at 30.64 Gb/ annum in 2007 translating to 83.95 mmbpd. According to BP, 2007 production was 81.44 mmbpd that was exceeded by 81.82 mmbpd in 2008. It is of course premature to call 2008 as peak year although I am increasingly skeptical that the 2008 production will ever be exceeded. If Duncan and Youngquist's unbiased accuracy follows through to Brazil and the 4 big gulf producers - Iraq, Kuwait, Saudi Arabia and the UAE, then this will underpin their 2007 peak oil forecast, reinforcing the view that 2008 saw the passing of peak oil.

Duncan and Younquist told us 10 years ago that peak oil will be buried in a bumpy plateau and

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that a number of years must pass before it will be evident from declining production that peak has indeed passed. The exact timing is unimportant. The important thing is the knowledge that we are within the plateau and that some scientists do understand the above and below ground factors leading to peak and that their warnings of decline past peak and its consequences should not be ignored.

For new readers, here is a list of Oil Drum Articles on Saudi Arabia and Ghawar as of August 2007.

by Stuart Staniford

- [Saudi Arabia and Gas Prices](#)
- [Depletion Levels in Ghawar](#)
- [The Status of North Ghawar](#)
- [Further Saudi Arabia Discussions](#)
- [Water in the Gas Tank](#)
- [A Nosedive Toward the Desert](#)
- [Saudi Arabian oil declines 8% in 2006](#)

by Euan Mearns

- [Ghawar reserves update and revisions \(1\)](#)
- [GHAWAR: an estimate of remaining oil reserves and production decline \(Part 2 - results\)](#)
- [GHAWAR: an estimate of remaining oil reserves and production decline \(Part 1 - background and methodology\)](#)
- [Saudi production laid bare](#)
- [Saudi Arabia and that \\$1000 bet](#)

by Heading Out

- [Simple mathematics - The Saudi reserves, GOSPs and water injection](#)
- [Of Oil Supply trains and a thought on Ain Dar](#)

by Ace

- [Updated World Oil Forecasts, including Saudi Arabia](#)
- [Saudi Arabia's Reserve "Depletion Rates" provide Strong Evidence to Support Total Reserves of 175 Gb with only 65 Gb Remaining](#)
- [Further Evidence of Saudi Arabia's Oil Production Decline](#)



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